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BIO-PHYSICAL LAND SUITABILITY ASSESSMENT

for selected land-use systems in the province of Sanmatenga, Burkina Faso

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August 1998

LEECON for SLM
Consultants for Sustainable Land Management, Wageningen

Preface

Land suitability maps claim to present the suitability of regionally defined Land Units for specific Land Use(s). One should be aware that the specifications of a Land Unit are not entirely static; weather specifications, for instance, may vary strongly between years. This frequently calls for adapted management, which alters Land Use specifications. All of this has repercussions for Land-Use System performance and therewith for the apparent suitability of the Land Unit.
The foregoing implies that Land Suitability Maps can merely be indicative because they refer to a hypothetical Land-Use System (with formal soil/terrain, weather and management specifications) that might deviate strongly from the 'real' system(s) in a particular year. To cope with this complexity, PEDI has requested to investigate the performance of formalised Land-Use Systems, based on 'standard' management practices, commonly grown annual food crops and weather specifications that represent 'dry', 'normal' and 'wet' years. However, note that not only the quantity of available rainfall influences 'land suitability' but also its timing.
'Standard' management is never applied. Farmers adapt their practices to the situation at hand through changes in sowing date(s), sowing density, choice of variety, water and nutrient applications, etc. It follows that the tables generated in this study present **indicative** suitability classes for defined Land-Use Systems. If these are projected onto the Land Unit Map of Sanmatenga, one obtains **indicative** Land Suitability Maps that show broad levels and trends but cannot claim to be accurate in all situations.

Accurate land suitability assessment can only be hoped for if individual Land-Use Systems are studied, i.e. systems at a particular site with accurate daily weather data and 'real' management information. A single Land Suitability map cannot express the considerable variation in Land-Use System specifications between sites, years and farmers. Land Use Planning is better based on multiple point-based analyses than on (a few) general maps. The methodology developed in this study holds promise for such applications. Further research along the lines explored is strongly recommended.

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August, 1998.

Introduction

This study was made possible by the Antenne Sahélienne and the Department of Environmental Sciences (laboratory of soil science & geology) of Wageningen Agricultural University (WAU). It contributes to the agreement between the Antenne Sahélienne and DGIS / PEDI. The basis is led by work starting in 1994. Van Asten & van de Pol (1996) and van Lieshout et. al. (1997) gathered and mapped the environmental data of the province. Leenaars provided and transformed the necessary weather data (1996). Driessen et.al. (1997) developed and described the methodology of the bio-physical land suitability assessment (BFSUIT).

The aim of this study is to assess land suitability in the province of Sanmatenga for seven selected land-use systems, worked out for years with relatively low, average and high rainfall, using the above mentioned data and methodology and to provide the results in database format prior to geo-referencing.

1. THE STUDY AREA

The study area covers the whole of the province of Sanmatenga in Burkina Faso, except for the three south-eastern departments. The total area evaluated is about 7200 km^2 and stretches north-south between Universe Transverse Mercator (UTM) coordinates 1544 and 1420 and west-east between UTM coordinates 655 and 753. Some two third of the area is situated in the soudano-sahelian agro-climatic zone. The north stretches into the south-sahelian zone and the south into the north-soudanian zone.

Geologically, two major strata can be distinguished. The Birrimian stratum situated in the southern and north-eastern part of the province and the Anté-Birrimian stratum occupying the larger part of the province.

2. LAND USE

Major kinds of land use in the study area are traditional rain-fed agriculture and extensive grazing.

2.1 Land Utilisation Types

2.1.1 Land utilization types at provincial scale

In the present study seven land utilisation types (LUT's) were defined and evaluated. A LUT is defined in BFSUIT as a unique combination of a crop or natural vegetation type and applied management.

Crops evaluated were:
- millet (petit mil; *Pennisetum typhoides)*
- sorghum (sorgho; *Sorghum bicolor*)
- maize (mais; *Zea mays*)
- rice (riz; *Oryza sativa*)
- soybean (soya; *Glycine max*)
- groundnut (arachide; *Arachis hypogaea*)
- cowpea (niébé; *Vigna unguiculata*)

The crop parameters used were as defined by Driessen et.al. (1997). Parameters for maize and cowpea were defined on the basis of available data and adjusted during model calibration (see § 2.3)

Management practices defined were comparable with those defined by Driessen et. al. (1997) and varied as little as possible in order to allow comparison between crops. The land suitability was evaluated with BFSUIT assuming adequate availability of time, labor and fertilizers. The same was done in the present study but an additional evaluation was done assuming limiting availability of (time, labor and mineral and) organic fertilizers. The difference between this scenarios is reflected only in the different fertilization regime and different rating criteria for soil fertility. This distinction was made because it is unknown whether the physical availability of fertilizing organic materials is sufficient to support adequate and sustainable mineral fertilization (see figure 5).

<u>Germination date</u>: Driessen et. al. (1997) used a constant germination date of JDN 170 (mid-June). In this study germination dates differ because three years with different rainfall were considered. The model applied to assess water availability (see § 4.1.1) is very sensitive to the germination date, like in reality.
The three years were identified by running the model for 33 years and summing the rainfall from the sowing date onwards. The fixed sowing dates were defined using cropping calendars as a function of agro-climatic zoning (Verheye/Bunasols, 1990, Verberne et. al, 1994). The starting dates of simulation were defined after

analyzing the rainfall patterns of the three selected years individually. Simulation for the selected year with an average amount of rainfall (1978) starts for Ouagadougou at JDN 160 and for Dori at JDN 165. Rice is sown 5 days earlier and maize 10 days later.
As done by Verberne et.al., sowing in the model is defined to take place only after three rainfall events. Germination is defined to take place when the soil moisture content exceeds a threshold value, set at 4444 hPa for all crops, except for rice *(psiint = 555 hPa)*.

Change of variety: A short cycle variety is sown, conform Verberne et.al. (1994), when the above mentioned conditions for sowing are not met within 21 days. This variety is assumed to have a cycle of 0.8 * the 'normal' cycle.

Soil tillage: Soil tillage is supposed to create a soil surface water storage capacity of 1 cm. for most crops. Maize is tilled slightly more intensively and a capacity of 2 cm. was defined. Soybean is cultivated in beds with ridges of 4 cm. high and rice in basins with a depth of 5 cm. The initial amount of water on top of the soil surface was set at 1 cm. in all situations, which is rather high, except for rice were 5 cm. of water is initially standing on the soil surface.

Fertilization: Adequate fertilizer supply and lack of fertilization were assumed respectively for the scenarios with relatively high and low availability of (time, labor and mineral and) organic fertilizers.
An evaluation based on dynamic simulation of the water- ánd nutrient limited multi-year crop production was considered worthwhile (in addition to the simulation of solely water-limited crop production; see § 4.1.1 and chp. 6).

Irrigation: Rice received supplementary irrigation with net doses of 4 cm. at relative development stages 0.4, 0.55, 0.7 and 0.8.

Please note that the evaluation of the above LUT's can only approximate the actual suitability for arable crop production in the province. The currently practiced management is highly strategic and dynamic and cannot be accurately defined by a formal management package. The above-defined combinations of parameter settings are but a few out of an unlimited number of possibilities. Straightforward interpretation of the results may be misleading and it is highly recommended to use (a version of) BFSUIT as a tool to analyze the effects of varying parameter values in a given situation.

2.2 Land Use Requirements

Land use requirements selected are
- adequate water availability
- adequate reliability of water supply (if more than one year is considered)
- adequate protection against flooding
- adequate oxygen availability
- adequate nutrient availability
- adequate workability (conditions for soil tillage, germination and water infiltration)
- absence of erosion

2.3 Calibration

The crop parameter settings for maize and cowpea were estimated on the basis of available data. Values for maize were as suggested by Verberne et. al. (1994) and Fisher and Palmer (1993) and crop parameter values for cowpea follow suggestions by Summerfield et. al. (1993). General crop data were derived from Driessen & Konijn (192), Boons-Prins et. al. (1993) and van Heemst (1988). These parameter values were adjusted using experiment data. Model calibration for maize was based on Verberne et. al. (1994) and for cowpea on Koné & Groot (1996).

2.3.1 Cowpea

Cowpea has been researched in Niono and Cinzana, Mali, in the context of the project 'Production Soudano-Sahélienne' (PSS). Some results are published (Koné & Groot, 1996) and available. More detailed data could not be made available by the AB-DLO research center though some of the corresponding weather data of Cinzana could.

The potential above ground dry matter production in the 750 mm. zone of Cinzana was reported to be about some 9 tons /ha. Reported measured maximum above ground dry matter productions (kg /ha) at maturity in Cinzana were:

	Sandy soil	Loamy sand soil	Clayey soil
1992	5000	6000	3500
1993	3200	5500	4400
1994	4600	7600	7000

The total rainfall was 700 mm. in 1992 and 520 mm. in 1993. No data for 1994 were available but it was reported that the rainfall sum was 'relatively high'. The reported management data lacked the dates of sowing and maturity.

Simulated above ground dry matter (kg /ha) at maturity in 1992 as a function of soil texture and sowing date:

	Sown	Sandy soil	Loamy sand soil	Clayey soil	Potential
1992	155	4800	-	7500	7800
	160	4600	-	3900	7700
	165	4500	2350	6400	7900
	170	4500	1500	6400	8050
	175	4200	5000	5600	8200
	180	3750	2700	4800	8400
	185	3550	-	4400	8500
	190	3750	1150	4100	8400
	195	4250	4600	3900	8500
	200	5200	-	4800	8600
	205	5600	5000	6100	8600
	210	5550	4600	6050	8650
	215	4700	-	5600	8600

Simulated above ground dry matter (kg /ha) at maturity in 1993 as a function of soil texture, sowing date and the initial electrical conductivity of the saturated soil extract (mS/cm):

	Sown	Sandy soil		Loamy sand soil		Clayey soil		Potential
	Ece =	0.2	1	0.2	1	0.2	1	
1993	160	5650	-	3800	-	6200	5900	8250
	170	6700	-	1400	6000	8600	8600	8900
	180	7850	3300	-	-	8400	8400	9200
	190	7650	3850	6800	-	7600	7600	9200
	195	7150	4300	4750	4550	7300	7200	9150
	200	6800	3400	6200	6400	6900	6800	9150
	210	6450	3150	5500	5200	5650	5600	9100

The duration of the crop cycle is between 70 and 75 days. Cowpea can be harvested earlier than sorghum or millet when sown together. The simulated potential above ground dry mass is up to 9 tons /ha, depending on the sowing date. It is evident that the model is difficult to calibrate for cowpea without good data on crop management. Nevertheless, the simulated attainable production figures are within the ranges as observed in Cinzana. Maximum simulated leaf area indices (LAI) were near 6 m^2/m^2.

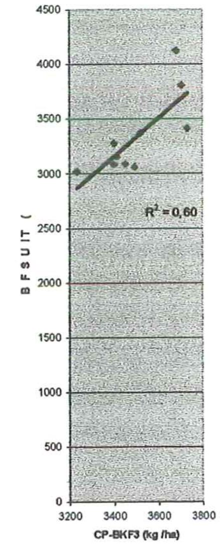
For 1992, production is best simulated for sandy soil, where the results are also little influenced by varying sowing date. The simulated production on the loamy sand soil appears extremely sensitive to sowing date. The production on clayey soil is consequently overestimated. The best fit for all soils together seems to be when sowing date is JDN 195.

For 1993 we see that the production is best simulated for loamy sand soil. The production on the sandy and clayey soils is consequently overestimated. Increasing the initial electrical conductivity of the soil water from 0.2 to 1 mS /cm, what is still considered low, the simulated production is near the observed values on both the sandy and the loamy sand soils, though the chance of crop failure increases.

2.3.2 Maize

For maize the parameter values were set after the values used by simulation model CP-BKF3 (Verberne et.al., 1994). Assimilate partitioning for sorghum and millet was also derived from this source.

The biophysical and the water-limited yield potentials of maize were simulated with weather data of the years 1981 – 1990. The results were compared with the simulation results as obtained with CP-BKF3. Similar sowing dates were assumed.



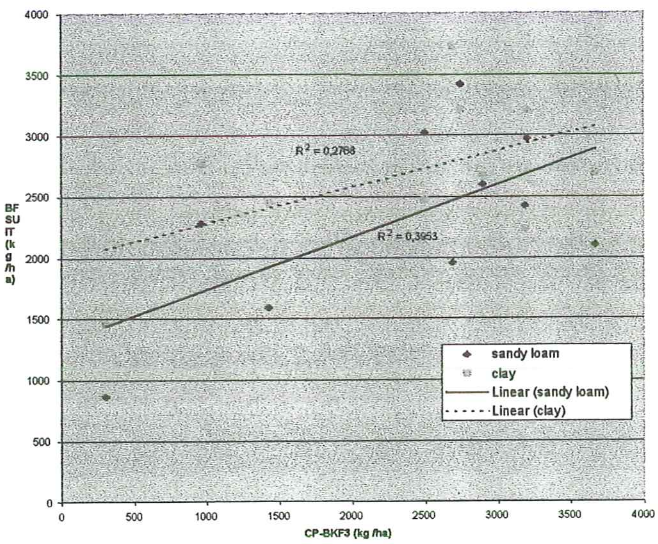


Figure 1 a & b. Comparison between the maize yields simulated with the models CP-BKF3 and BFSUIT. Biophysical yield potential (a.) and water-limited yield potential (b).

The correlation of the bio-physical yield potential simulated with BFSUIT with the simulation with CP-BKF3 is indicated by $R^2 = 0.6$. While CP-BKF3 simulates a range of yields from 3200 to 3700 kg /ha, BFSUIT suggests a range from 3000 to 4200 kg /ha.

On a sandy loam soil $R^2 = 0.4$ when comparing the simulated water-limited yield potentials. One extra level of complexity (water) introduces diverting results. The crop parameters however seem well defined.

3. SOILS AND LAND UNITS

Land use practices and land use potentials are largely conditioned by local soil, terrain and weather conditions. Weather data were kindly provided by AB-DLO. 33 consecutive years of daily weather data of the synoptic stations of Dori and Ouagadougou were converted to the desired format of BFSUIT (Leenaars, 1996 see annex 1).
Soil and terrain data were collected and mapped by Van Asten and Van der Pol (1996) and by Van Lieshout et.al. (1997) and kindly provided in *.mdb format. The map is of a physiographic nature and presented in ArcView format. The related database files are in *.adf format, not directly accessible.

The legend structure of the physiographic map is hierarchic. Geological units are divided into physiographic units, divided into soil families, divided into soil series. For evaluation purposes, individual soil series were considered (land units). Originally, selected soil series were considered representative for entire soil families and the results were subsequently projected onto the mapping unit (physiographic unit) using the reported frequencies of occurrence of soil families per physiographic unit. Because the results appeared unsatisfactory, individual soil series were assessed and aggregated to be presented as associations. The resulting suitability classes appeared to vary strongly with the 'representative' profile chosen. The representativity of a single soil profile is questionable. In the present version, all available data are used. Each observation point per legend unit was evaluated and a suitability class was assessed. Each profile was considered equally representative for further aggregation.

Table 1. Mapping units, soil frequencies per mapping unit and representative soil profiles per soil unit. * indicates the absence of chemical data, ** indicates the absence of horizon data.

Physiographic mapping unit	Soil frequencies	Representative soil profiles
Hills and upper slopes (AC1)		
soil unit AC1a	10 %	262*, 331
soil unit AC1b	35 %	740, 768, 769, 807
soil unit AC1c	55 %	741, 805, 918
Plateaux (B1)		
soil unit B1a	? %	24*
soil unit B1b	? %	715*
Eroded and/or less developed indurated caps (B2)		
soil unit B2a	50 %	323*
soil unit B2b	10 %	801*
soil unit B2c	5 %	712*, 760*, 908*
no soil	35 %	-
Crusted middle slopes (C21)		
soil unit C21a	35 %	221*
soil unit C21b	65 %	121, 122, 127**
Non-crusted middle slopes (C22)		
soil unit C22a	40 %	128, 332
soil unit C22b	30 %	271*, 135

soil unit C22c	30 %	304*
Eroded lower slope (C31)		
soil unit C31a	65 %	134
soil unit C31b	10 %	719*, 913*
soil unit C32a	15 %	316*
soil unit D1c	10 %	132
Non-eroded lower slope (C32)		
soil unit C32a	50 %	123, 133, 342
soil unit C32b	10 %	124
soil unit C32c	10 %	316*
soil unit C32d	10 %	333
soil unit C32e	10 %	26*
soil unit C32f	10 %	131, 344
Crusted lower/middle Birrimian slope (C41)		
soil unit C41a	50 %	917
soil unit C41b	50 %	743, 803
Non-crusted lower/middle Birrimian slope (C42)		
soil unit C42a	20 %	738, 739, 742
soil unit C42b	30 %	772, 920
soil unit C42c	50 %	776, 778, 780, 790, 792
Crusted Birrimian valley (C51)		
soil unit C51a	100 %	799*
Non-crusted Birrimian valley (C52)		
soil unit C52a	25 %	770, 919
soil unit C52b	15 %	911*
soil unit C52c	25 %	746*, 905*
soil unit C52d	20 %	728*
soil unit C52e	5 %	706*
soil unit C52f	10 %	703*
Small valley (D1)		
soil unit D1a	40 %	172*
soil unit D1b	20 %	284*
soil unit D1c	40 %	132
Large valley (D2)		
soil unit D2a	40 %	334
soil unit D2b	35 %	137, 343
soil unit D2c	25 %	136**, 345
Plain (D3)		
soil unit D3a	40 %	125, 162*
soil unit D3b	60 %	126
Aeolian complex (E)		
soil unit Ea	45 %	163*
soil unit Eb	45 %	164*
soil unit D3a	10 %	125, 162*

Initially this approach gave evaluation results that were not conform reality. As suggested earlier, it may be doubted whether the selected soil profiles are representative. Therefore all observation points in each mapping unit were evaluated and aggregation was done assuming equal frequencies. A more sophisticated method for aggregation is suggested in § 3.1.

3.1 Correlating mapping units with traditional soil units

Interpreting Niébé et. al. (1995) yielded the determination of the frequencies of occurrence of the local soil names within physiographic units in two geological strata in the province of Bam. These hold also for the province of Sanmatenga because of the similar geology, geomorphology and climate. For the province of

Sanmatenga the decision rules described by Schutjes and van Driel (1994) could be applied to classify soil data according to this local nomenclature. Labeling these local soils with the above mentioned frequencies of occurrence allows aggregation of the evaluation results by mapping unit.
Such a procedure would assess soil suitability in a manner which is scale independent and applicable in any situation. See chapter 6 for some additional remarks.

This approach was not applied by Driessen et.al. (1997) and falls outside the scope of this study.

3.2 Land qualities

The land units, corresponding with the mapping units, have characteristic qualities that meet the corresponding land use requirements at least to a certain extent.

Land Use Requirements	Land Qualities
- adequate water availability	water availability over time
- adequate reliability of water availability	yearly variance of water availability
- adequate oxygen availability	oxygen availability
- adequate nutrient availability	nutrient availability over time
	nutrient retention capacity
- adequate workability	impact of slope
	impact of tools selection
	impact of soil surface crusting
- absence of erosion	erodability

In § 4.1 is explained which land characteristics were selected to evaluate the qualities of the land.

4. LAND SUITABILITY ASSESSMENT

Land suitability assessment is often labeled as 'qualitative' or 'quantitative'. The former, conventional one, expresses the sufficiencies of (only) 'relevant' land properties in terms of indicative (i.e. tabulated, static) ratings for individual properties. Its static nature allows only a comparative evaluation of the suitability of land units. Quantitative land suitability assessment has a dynamic nature and describes and interprets the processes that take place rather than interpreting the results of these processes.

The land qualities 'water availability' and 'reliability of water availability' were evaluated dynamically. The results of these analyses and evaluations of the other land qualities were aggregated qualitatively by rating.

BFSUIT could not be applied in its original version. The terrain, soil-physical and soil-chemical data were provided in database format (MS-Access); BFSUIT had to be rewritten to allow data entry from file. The input files were constructed by querying the database and conversion to ASCII comma-delimited format. The evaluation results depend entirely on the input data.

4.1 Rating of land qualities

The criteria used in BFSUIT for rating individual (clusters of) land qualities / limitations were based on those used by the National Bureau of Soils in the province of Bam (Bunasols, 1995). Nearly similar criteria were used in the present version albeit that they were slightly differentiated according to crop specific requirements (Bunasols, 1995, FAO, 1978).
A few 'new' qualities were incorporated in the evaluation procedure, viz. flooding hazard and multi-year reliability of water availability to support analyses of more than one year. The ratings for nutrient availability and nutrient retention capacity were adapted to allow evaluation for low input agriculture.

4.1.1 Water availability

The daily supply of water to the crop is governed by management and by the soil and the weather. Daily water sufficiency depends also on crop characteristics.

Soil input data were derived from the provided soil database. 'New' input data considered in the evaluation of the water availability were gravel and rock content and soil depth. Default soil hydrologic properties were defined as a function of texture class as suggested by Driessen & Konijn (1992).

Weather input data were converted from data used for the crop growth model CP-BKF (see annex 1). Running an adapted version of BFSUIT for all 33 years allowed to determine years with relatively low, average and high rainfall for both Dori and Ouagadougou. Note that these years were determined by summing the rainfall from recommended dates of sowing onwards. (JDN 200 for Dori and JDN 180 for Ouagadougou). Earlier rainfall was not considered.

1984 low rainfall
1978 medium rainfall
1964 high rainfall

Spatial redistribution of water was accounted for by introducing an option to simulate soil water run-off. Lower toposequential positions receive this water as run-on, corrected for the relative acreage.

4.1.1.1 Dynamic simulation of the bio-physical yield potential and attainable yield

The potential crop production, exclusively conditioned by the photosynthetic properties of the crop, solar radiation and temperature, represents cropping in a constraint-free environment. Crop growth simulation yields the bio-physical yield potential (PS1). It results from the numerical integration over time of state variables, using short time intervals (here one day) from germination to maturity. The attainable yield or water-limited yield potential (PS2) is calculated using the same procedure but incorporating one more constraint: daily water availability. The water requirements for constraint-free crop growth are known. Assimilation of atmospheric CO_2 is accompanied by loss of water vapour, known as crop transpiration. Transpiration stops when the stomatal openings close i.e. when the daily water supply is critically short. Consequently, assimilation stops. Actual transpiration relative to maximum transpiration indicates the reduction of gross assimilation in a situation of water stress.

For a detailed description of the method, the functional relations used, the algorithm and the data needs, the reader is referred to Driessen & Konijn, 1992.

4.1.1.2 Rating of water availability

The bio-physical yield potential (yld1) and the attainable yield (yld2) were calculated for each selected combination of crop, management, soil and weather. Matching the attainable yield with the bio-physical yield potential (yld2 / yld1) expresses the sufficiency of water availability in a rating.
A similar procedure was followed to calculate the multi-year average yld2 / yld1 ratio, indicating the average sufficiency of water availability. The reliability of water availability was assessed by counting the number of years with a 'low' ratio, relative to the total number of years (max. 33).

The ratings used to express the comparative sufficiency of water availability to the crop are as used by BFSUIT (Driessen et. al., 1997).

```
MULTIYEARAVERAGEWATERAVAILABILITY:
IF YEARNR = 1 THEN
      YLD1TOT = 0
      YLD2TOT = 0
END IF
YLD1TOT = YLD1TOT + YLD1
YLD2TOT = YLD2TOT + YLD2
YLD1AV = YLD1TOT / YEARNR
YLD2AV = YLD2TOT / YEARNR
DdEAUAV = YLD2AV / YLD1AV
'
IF     DdEAUAV < .2 THEN        RATdEAUAV = 5
ELSEIF DdEAUAV < .35 THEN       RATdEAUAV = 4
ELSEIF DdEAUAV < .5 THEN        RATdEAUAV = 3
ELSEIF DdEAUAV < .75 THEN       RATdEAUAV = 2
ELSE                            RATdEAUAV = 1
END IF

MULTIYEARRELIABILITY:
IF YEARNR = 1 THEN SUMDROUGHT = 0IF RATdEAU = 4 OR RATdEAU = 5
THEN SUMDROUGHT = SUMDROUGHT + 1RISK = SUMDROUGHT / YEARNR
IF     RISK < .1 THEN           RATRISK = 1
ELSEIF RISK < .3 THEN           RATRISK = 2
ELSEIF RISK < .5 THEN           RATRISK = 3
ELSEIF RISK < .75 THEN          RATRISK = 4
ELSE                            RATRISK = 5
END IF
```

Note that ratings vary with varying management practices. The rating is notably sensitive to the choice of sowing date.

4.1.2 Rating of oxygen availability

The drainage classes used in this study differ slightly from the drainage classes defined in BFSUIT. The reason for this difference is the provided data.

```
IF DRNCLSS = 1 THEN RATDRAIN = 4    (excessively drained)
IF DRNCLSS = 2 THEN RATDRAIN = 2    (somewhat excessively drained)
IF DRNCLSS = 3 THEN RATDRAIN = 1    (well drained)
IF DRNCLSS = 4 THEN RATDRAIN = 2    (mod. well / imperfectly
drained)
IF DRNCLSS = 5 THEN RATDRAIN = 5    (poorly drained)
'
IF CROPLABEL$ = "RIZ" THEN
IF DRNCLSS = 1 THEN RATDRAIN = 5
IF DRNCLSS = 2 THEN RATDRAIN = 5
IF DRNCLSS = 3 THEN RATDRAIN = 4
IF DRNCLSS = 4 THEN RATDRAIN = 3
IF DRNCLSS = 5 THEN RATDRAIN = 1
END IF
IF CROPLABEL$ = "MIL" AND DRNCLSS = 4 THEN RATDRAIN = 3
IF CROPLABEL$ = "SORGHO" AND DRNCLSS = 5 THEN RATDRAIN = 4
```

4.1.3 Rating the risk of flooding:

```
IF FLOOD = 1 AND CROPLABEL$ <> "SORGHO" AND CROPLABEL$ <> "RIZ"
THEN
      RATFLOOD = 4
ELSEIF FLOOD = 0 AND CROPLABEL$ = "RIZ" THEN
      RATFLOOD = 3
ELSE
      RATFLOOD = 1
END IF
```

4.1.4 Rating nutrient availability and nutrient retention capacity:

The nutrient retention capacity was evaluated in BFSUIT by considering the average of the sub-rating for organic matter content and the (corrected) sub-ratings for texture class and pH. The lower of the two ratings was retained as an expression of the overall sufficiency of soil fertility.

In the present study, the pH is rated differently for different crops and influences the appreciation of 'base saturation' and 'risk of phosphate fixation'. The texture class as an indicator of the cation exchange capacity was replaced by the measured cation exchange capacity. The organic matter content was considered to condition current nutrient availability, notably in land units with advanced mineral weathering. The sub-ratings for nutrient retention capacity and current nutrient availability could be considered separately but were retained together like in BFSUIT.

In high-input agriculture, i.e. with adequate availability of time, labor and fertilizers, current nutrient availability is of relatively low significance and consequently the sub-rating for CEC was reduced by maximally one rating-unit for soils whose organic matter content appeared more limiting than the CEC. (Note however that the combined application of mineral and organic fertilizers yields a higher production than when applying high doses of mineral fertilizers only; see figure 5).

In low-input agriculture or semi-traditional rain-fed agriculture, current nutrient availability is of paramount importance and consequently the sub-rating for CEC was made up to two rating-units more limiting for soils whose organic matter content appeared more limiting than the CEC.

Alternatively, it might be worthwhile to evaluate the sufficiency of nutrient availability as a function of the ratio of nitrogen-limited attainable yield over water-limited attainable yield, comparable with the procedure to evaluate the sufficiency of water-availability. Subsequently, CEC, BS (base saturation) and pH / texture reflecting the phosphate fixation could be used to downgrade the suitability rating as needed. See figure 2 where the sufficiency of nutrient availability varies with varying water availability.

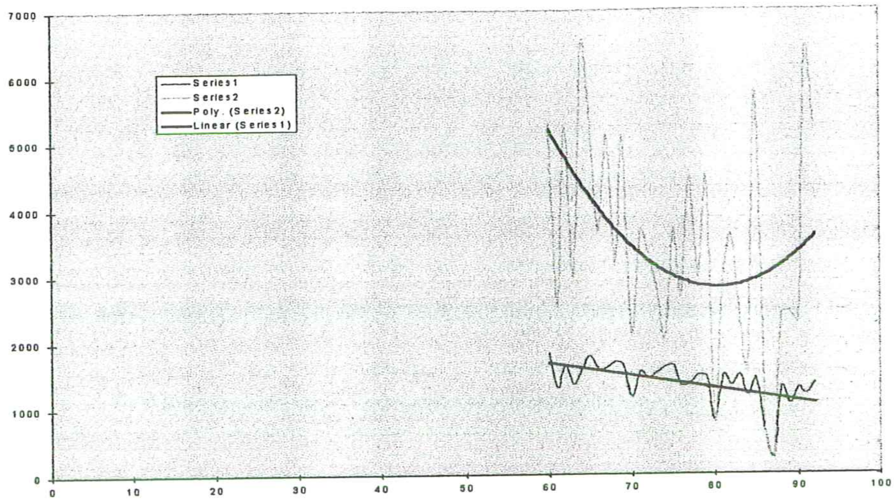


Fig.1. 33-year trend lines of simulated sorghum productivity on an Arenosol at Dori Curve 1. represents the nutrient and water-limited potential productivity, curve 2. the water-limited potential productivity. (From van Haaften et.al., 1998).

```
PH: ' Use the pH(H2O) of the 1st or the 1st & 2nd horizon,      to a
depth of maximally 40 cm.
'
IF PH < 4.5 THEN                                    RATPH = 5
IF CROPLABEL$ = "RIZ" THEN                          RATPH = 4
ELSEIF PH < 5 THEN                                  RATPH = 4
IF CROPLABEL$ = "RIZ" OR "NIEBE" THEN               RATPH = 3
ELSEIF PH < 5.5 THEN                                RATPH = 3
IF CROPLABEL$ = "RIZ" OR "NIEBE" THEN               RATPH = 2
ELSEIF PH < 6 THEN                                  RATPH = 2
IF CROPLABEL$ = "RIZ" OR "NIEBE" THEN               RATPH = 1
ELSEIF PH < 7 THEN                                  RATPH = 1
ELSEIF PH < 7.5 THEN                                RATPH = 1
IF CROPLABEL$ = "RIZ" OR "MAIS" OR "MIL" OR "SOYA" OR "NIEBE" THEN
                                                    RATPH = 2
ELSEIF PH < 7.8 THEN                                RATPH = 2
IF CROPLABEL$ = "MAIS" OR "MIL" OR "SOYA" OR "NIEBE" THEN
                                                    RATPH = 3
ELSEIF PH < 8.4 THEN                                RATPH = 3
IF CROPLABEL$ = "MAIS" OR "MIL" OR "SOYA" OR "NIEBE" THEN
                                                    RATPH = 4
ELSEIF PH < 9 THEN                                  RATPH = 4
ELSEIF PH <= 14 THEN                                RATPH = 5
END IF
```

```
OM:
' Use the carbon content (%) of the 1st or the 1st & 2nd horizon, to
maximally 40 cm.

OM$ = "Y"
OM = C * 1.72 * 100 (%)

IF CROPLABEL$ = "NIEBE" THEN
      Original BFSUIT settings:
```

```
        IF     OM < .25 THEN                    RATOM = 5
        ELSEIF OM < .5 THEN                     RATOM = 4
        ELSEIF OM < 1 THEN                      RATOM = 3
        ELSEIF OM < 3 THEN                      RATOM = 2
        ELSE                                    RATOM = 1
        END IF
ELSE
Settings reflecting the sufficiency relative to attainable average
water-limited yields:
        IF     OM < .25 THEN                    RATOM = 5
        ELSEIF OM < 1   THEN                    RATOM = 4
        ELSEIF OM < 1.5 THEN                    RATOM = 3
        ELSEIF OM < 2.5 THEN                    RATOM = 2
        ELSE                                    RATOM = 1
        END IF
END IF
```

CEC:

```
' Use the cation exchange capacity of the 1st, the 1st & 2nd or the
1st , '2nd & 3rd horizon:

IF CEC < 4 THEN                                 RATCEC = 5
IF CEC >= 4 AND CEC < 8 THEN                    RATCEC = 4
IF CEC >= 8 AND CEC < 12 THEN                   RATCEC = 3
IF CEC >= 12 AND CEC < 16 THEN                  RATCEC = 2
IF CEC >= 16 THEN                               RATCEC = 1
'
IF CARTECODE$ = "C41" OR "C42" OR "C51" OR "C52" OR "AC1" THEN
VW$ = "L"
IF VW$ = "L" THEN                               RATCEC = RATCEC - 1
(low weathering status in Birrimian)
'
The final rating of soil fertility is equal to the lower one of
the sub-ratings for acidity (pH) and exchange capacity (CEC). The
sub-rating for exchange capacity is corrected for current nutrient
availability, to a large extent determined by soil the organic
matter.
'
RATNDIFF = RATOM - RATCEC
IF RATNDIFF > 2 THEN                            RATEXCH = RATCEC + 2
IF RATNDIFF => 1 AND RATNDIFF <= 2 THEN         RATEXCH = RATCEC + 1
ELSE                                            RATEXCH = RATCEC
END IF

Note: RATEXCH = RATCEC + 1 if RATNDIFF => 1 for scenarios with
high input agriculture, where inherent soil fertility is of less
significance.
'
IF RATPH > RATEXCH THEN                         RATNUT = RATPH
ELSE                                            RATNUT = RATEXCH
END IF
```

4.1.5 Rating of workability:

The original rating of terrain slope in BFSUIT referred already to the workability. The original rating for rooting conditions considered 'gravel content' and 'soil depth'. These were made part of the rating of water availability. The parameters 'soil structure' and 'consistence' were retained to reflect workability. The original rating of 'the impact of surface crusts' reflected the ease of water infiltration and of germination.The three sub-ratings could be aggregated to one rating for 'workability' but they were considered separately like in BFSUIT. No changes were made.

4.1.5.1 Sub-rating of slope:

```
IF CROPLABEL$ = "RIZ" AND SLOPE > 1 THEN SLOPE = 5
IF CROPLABEL$ = "MIL" OR "SORGHO" AND SLOPE = 5 THEN SLOPE = 4
'
IF SLOPE = 1 THEN RATSLOPE = 1          (< 1%)
IF SLOPE = 2 THEN RATSLOPE = 2          (1 - 5 %)
IF SLOPE = 3 THEN RATSLOPE = 3          (5 - 10 %)
IF SLOPE = 4 THEN RATSLOPE = 4          (10 - 15 %)
IF SLOPE = 5 OR 6 THEN RATSLOPE = 5 (>15 %)
```

4.1.5.2 Sub-rating of soil tillage:

```
STRUCTURE: ` Use the data of the 1st or the 1st & 2nd horizon, to a
depth of maximally 60 cm.
Granular:    STRCTFRM = 1          Very fine:   STRCTSIZE = 1
Blocky:      STRCTFRM = 2          Fine:        STRCTSIZE = 2
Prismatic:   STRCTFRM = 3          Medium:      STRCTSIZE = 3
Columnar:    STRCTFRM = 4          Coarse:      STRCTSIZE = 4
                                   Very coarse:STRCTSIZE = 5

`X = HORIZON
FOR X = 1 TO 2
IF STRCTFRM(X) = 1                      THEN RATSTRUC(X) = 1
IF STRCTFRM(X) = 2 AND STRCTSIZE(X) = 1 THEN RATSTRUC(X) = 1
IF STRCTFRM(X) = 2 AND STRCTSIZE(X) = 2 THEN RATSTRUC(X) = 1
IF STRCTFRM(X) = 2 AND STRCTSIZE(X) = 3 THEN RATSTRUC(X) = 2
IF STRCTFRM(X) = 2 AND STRCTSIZE(X) = 4 THEN RATSTRUC(X) = 3
IF STRCTFRM(X) = 2 AND STRCTSIZE(X) = 5 THEN RATSTRUC(X) = 4
IF STRCTFRM(X) = 3 AND STRCTSIZE(X) = 3 THEN RATSTRUC(X) = 3
IF STRCTFRM(X) = 3 AND STRCTSIZE(X) = 4 THEN RATSTRUC(X) = 4
IF STRCTFRM(X) = 3 AND STRCTSIZE(X) = 5 THEN RATSTRUC(X) = 4   'was
5
IF STRCTFRM(X) = 4 AND STRCTSIZE(X) = 3 THEN RATSTRUC(X) = 3
IF STRCTFRM(X) = 4 AND STRCTSIZE(X) = 4 THEN RATSTRUC(X) = 4
IF STRCTFRM(X) = 4 AND STRCTSIZE(X) = 5 THEN RATSTRUC(X) = 4   'was
5
'
`the average rating for structure over two horizons:
RATSTRUC = ((RATSTRUC * UP(1)) + (RATSTRUC(2) * (LOW(2) - UP(2)))) /
LOW(2)
```

```
CONSISTENCE:
FOR X = 1 TO 2     (X = soil layer)
IF CNSST1(X) = 1 THEN RATCONS(X) = 1       (loose)
IF CNSST1(X) = 2 THEN RATCONS(X) = 1       (soft)
IF CNSST1(X) = 3 THEN RATCONS(X) = 2       (slightly hard)
IF CNSST1(X) = 4 THEN RATCONS(X) = 3       (hard)
IF CNSST1(X) = 5 THEN RATCONS(X) = 4       (very hard)
IF CNSST1(X) = 6 THEN RATCONS(X) = 5       (extremely hard)

'the average rating for consistence over two horizons:
RATCONS = ((CNSST1(1) * LOW(1)) + (CNSST1(2) * (LOW(2) - UP(2)))) /
LOW(2)

IF RATCONS > RATSTRUC THEN
      RATTOOL = RATCONS
ELSE
      RATTOOL = RATSTRUC
END IF
```

4.1.5.3 Sub-rating of surface crusting:

```
SEALING:
Slightly hard:     SEALCNSST$ = "1"        0 mm.:      SEALTHCK$ = "1"
Hard:              SEALCNSST$ = "2"        0-2 mm.:    SEALTHCK$ = "2"
Very hard:         SEALCNSST$ = "3"        2-5 mm.:    SEALTHCK$ = "3"
Extremely hard:    SEALCNSST$ = "4"        5-20 mm.:   SEALTHCK$ = "4"
                                           > 20 mm.:   SEALTHCK$ = "5"
IF SEALCNSST$ = "1" AND VAL(SEALTHCK$) < 3 THEN CRUST = 1
IF SEALCNSST$ = "1" AND SEALTHCK$ = "3" THEN    CRUST = 2
IF SEALCNSST$ = "2" AND VAL(SEALTHCK$) < 3 THEN CRUST = 2
IF SEALCNSST$ = "2" AND SEALTHCK$ = "3" THEN    CRUST = 3
IF SEALCNSST$ = "3" AND VAL(SEALTHCK$) < 3 THEN CRUST = 2
IF SEALCNSST$ = "3" AND SEALTHCK$ = "3" THEN    CRUST = 3
IF SEALCNSST$ = "4" AND SEALTHCK$ = "2" THEN    CRUST = 3
IF SEALCNSST$ = "4" AND SEALTHCK$ = "3" THEN    CRUST = 4
IF SEALCNSST$ = "4" AND SEALTHCK$ = "4" THEN    CRUST = 5
IF SEALCNSST$ <> "4" AND SEALTHCK$ = "4" THEN   CRUST = 4
IF SEALTHCK$ = "5" THEN                         CRUST = 5
```

4.1.6 Rating the impact of erosion:

The rating of erosion is based on the erosion index as reported for each mapping unit. Severity is judged one degree less severe than in the original BFSUIT. This may be reset to the original settings.

```
no erosion:        EROSIONINDEX = 1
slight erosion:    EROSIONINDEX = 2
moderate erosion:  EROSIONINDEX = 3
severe erosion:    EROSIONINDEX = 4
extreme erosion:   EROSIONINDEX = 5

RATEROSIE = EROSIONINDEX - 1
```

4.3 Conversion of partial ratings to land suitability classes

After rating of all land qualities, an overall suitability class is determined for each land unit. The overall suitability rating was obtained by interpreting the individual ratings according to generic conversion rules as proposed by Sys et. al. (1991). The originally applied generic conversion rules were later adapted in order to be able to account for any missing data. If for example 2 out of the 7 land qualities could not be evaluated and rated because of an incomplete data set for the observation point concerned then the maximum number of limitations considered for a certain overall suitability class was also decreased by 2 (NRLQS = 5)

```
VLAG1LIM = 4
VLAG2LIM = 3
ADAPTSYS = NRLQS - 7
VLAG1LIM = VLAG1LIM + ADAPTSYS
VLAG2LIM = VLAG2LIM + ADAPTSYS
IF VLAG1LIM < 0 THEN VLAG1LIM = 0
IF VLAG2LIM < 0 THEN VLAG2LIM = 0

SUITCLASS:
IF CLASS$ <> "N1" AND CLASS$ <> "N2" THEN
      IF (VLAG1 <= VLAG1LIM) AND (VLAG2 = 0) AND (VLAG3 = 0) THEN
            CLASS$ = "S1"
      ELSEIF (VLAG2 <= VLAG2LIM) AND (VLAG3 = 0) THEN
            CLASS$ = "S2"
      ELSE  CLASS$ = "S3"
      END IF
END IF
```

4.4 Decision rules for aggregation

The suitability classes generated for all selected soil profiles were assessed and labeled according to the most severely limiting land qualities.
Using decision rules, these individual evaluation results were aggregated to one suitability class for the whole mapping unit, presentable on a map. To avoid unnecessary complexity, these classes were labeled only for the land qualities water and nutrient availability ('w' & 'n').

IF FREQ X + Y > .66 AND FREQX = FREQY THEN CLASS = X-Y
IF FREQ X + Y > .66 AND FREQX = FREQY AND FREQ Z > .2 THEN CLASS = X-Y/Z

IF FREQ X > .5 AND FREQY = FREQZ THEN CLASS = X/Y-Z
IF FREQ X > FREQ Y > FREQ Z THEN CLASS = X/Y
IF FREQ X > FREQ Y > FREQ Z AND FREQ Z > .25 THEN CLASS = X/Y/Z
IF FREQ X > .5 AND FREQ Y > .25 THEN CLASS = X/Y
IF FREQ X > .75 THEN CLASS = X

(Where X = S2, the values.5 and .25 were changed to .4 and .3).

Class X/Y indicates an association of classes X and Y where class X dominates.
Class X-Y indicates an association of class X and class Y equally occurring.

Appending 'n' and 'w' labels was based on the following frequencies within the mapping units:

```
IF      FREQ x > .5 AND FREQ y > .25 THEN LABEL = xy
ELSEIF  FREQ y > .5 AND FREQ x > .25 THEN LABEL = yx
ELSEIF  FREQ x > .5 THEN LABEL = x
Etc.
```

5. LAND EVALUATION OF SANMATENGA

The results for all observation points for scenario 1 with relatively high availability of (time, labor, mineral and) organic fertilizers are presented in annex 5.

The evaluation results for sorghum and cowpea for three different years, two different weather stations and aggregated for all mapping units are presented here for scenarios with relatively high (1.) and low (2.) availability of (time, labor, mineral and) organic fertilizers. These two scenarios reflect management practiced on the house fields and the bush fields (see chapter 6).

The results are stored, for all crops, in *.dbf files and can be joined to polygon attribute tables for geo-referencing.

Scenario 1: relatively high availability of time, labor, organic fertilizers and phosphate

MAPCODE	SORDOR84	SORDOR78	SORDOR64	SOROUA84	SOROUA78	SOROUA64
AC1	N1/S2	S3w	S2/N1	N1/S2	S2	S2/S3-N1
B1	N1w	S3w	N1/S3w	N1/S3w	N1/S3w	N1/S3w
B2	N1/S3wn	S3wn	S3-N1	S3/N1wn	S3/N1	S3/N1
C21	N1wn	N1wn	N1n	N1n	N1n	N1n
C22	N1/S3wn	S3/N1wn	S3/N1n	S3/N1n	S3/N1n	S3/N1n
C31	S3-N1	S3-N1w	S3-N1	S3-N1	S3-N1	S3-N1
C32	N1/S2/S3	S3/N1w	S2/S3	S2/S3	S2/S3	S2/S3
C41	N1/S3w	S3/N1w	S3/N1	S3/N1	S3/N1	S3/N1
C42	N1/S3w	S3/S2w	S2/N1	S2/S3	S2/S3	S2/S3
C51	X	X	X	X	X	X
C52	S2/S3w	S3w	S2	S2	S2	S2
D1	N1/S3	S3-N1	N1/S3	N1/S3	N1/S3	N1/S3
D2	S3-N1	S3/N1	S3-N1	S3-N1	S3-N1	S3-N1
D3	S3/N1wn	S3/N1nw	S3/N1n	S3/N1n	S3/N1n	S3/N1n
E	S3/N1n	S3/N1	S3/N1n	S3/N1n	S3/N1n	S3/N1n

MAPCODE	NIEDOR84	NIEDOR78	NIEDOR64	NIEOUA84	NIEOUA78	NIEOUA64
AC1	N1wn	N1wn	N1/S2	S2/N1	S3-N1/S2	N1/S3w
B1	N1w	N1w	N1w	N1w	N1/S3w	N1w
B2	N1wn	N1/S3wn	N1/S3wn	S3-N1wn	S3-N1wn	N1/S3wn
C21	N1wn	N1wn	N1	N1nw	N1nw	N1wn
C22	N1wn	N1/S3wn	N1nw	N1nw	N1/S3n	N1wn
C31	N1w	N1w	N1/S3	N1/S3	N1/S3	N1/S3
C32	N1w	N1/S3w	N1/S2	N1/S2	S2/N1/S3	N1/S2
C41	N1w	S3-N1w	N1w	N1w	S3-N1	N1w
C42	N1w	N1/S3w	N1/S2	N1/S2	S2/N1	N1/S2
C51	X	X	X	X	X	X
C52	N1w	N1w	S2/N1	S2/N1	S2	S2/N1
D1	N1	N1	N1	N1	N1	N1
D2	N1	N1	N1	N1	N1	N1
D3	N1wn	N1/S3wn	N1/S3n	N1/S3n	N1/S3n	N1/S3n
E	N1wn	S3-N1wn	S3-N1n	S3-N1n	S3-N1n	S3-N1n

Scenario 2: relatively low availability of time, labor, organic fertilizers and phosphate

MAPCODE	SORDOR84	SORDOR78	SORDOR64	SOROUA84	SOROUA78	SOROUA64
AC1	N1w	N1w	S2	S2/N1	S2/N1	S2/S3
B1	N1w	N1w	N1/S3w	N1/S3w	S3/N1w	N1/S3w
B2	N1wn	N1/S3wn	S3/N1nw	S3/N1nw	S3/N1nw	S3/N1nw
C21	N1wn	N1wn	N1n	N1n	N1nw	N1n
C22	N1wn	N1/S3wn	S3/N1n	S3/N1n	S3/N1n	S3/N1n
C31	N1/S3	N1/S3	S3-N1n	S3-N1n	S3-N1n	S3-N1n
C32	N1/S3wn	S3/N1n	S3/N1n	S3/N1n	S3/N1n	S3/N1n
C41	N1/S3wn	S3-N1wn	S3-N1	S3/N1n	S3/N1n	S3/N1
C42	N1wn	S3/N1wn	S3/N1n	S3/S2-N1n	S3/S2-N1n	S2/S3
C51	X	X	X	X	X	X
C52	N1/S2w	S2/S3-N1	S2	S2	S2	S2
D1	N1/S3wn	S3-N1n	S3-N1n	S3-N1n	S3-N1n	S3-N1n
D2	S3/N1	S3/N1	S3/N1	S3/N1	S3/N1	S3-N1
D3	N1/S3wn	S3/N1nw	S3/N1n	S3/N1n	S3/N1n	S3/N1nw
E	S3-N1wn	S3/N1n	S3/N1n	S3/N1n	S3/N1n	S3/N1n

MAPCODE	NIEDOR84	NIEDOR78	NIEDOR64	NIEOUA84	NIEOUA78	NIEOUA64
AC1	N1wn	N1wn	S3-N1/S2	S3-N1/S2	S2/S3-N1	N1wn
B1	N1w	N1w	N1w	N1w	N1/S3w	N1w
B2	N1wn	S3-N1wn	S3/N1nw	N1/S3wn	S3/N1wn	N1wn
C21	N1wn	N1wn	N1wn	N1nw	N1nw	N1wn
C22	N1wn	N1wn	N1/S3nw	N1nw	N1/S3nw	N1wn
C31	N1wn	N1wn	N1/S3n	N1/S3n	N1/S3n	N1wn
C32	N1wn	S3/N1n	S3/N1n	S3/N1n	S3/N1n	N1wn
C41	N1wn	N1wn	N1wn	N1wn	N1/S3wn	N1wn
C42	N1wn	N1/S3	S3/N1	N1/S3wn	N1/S3wn	N1wn
C51	X	X	X	X	X	X
C52	N1w	N1/S2w	S2/N1	S2/N1	S2	N1w
D1	N1wn	N1	N1n	N1n	N1n	N1
D2	N1	N1	N1	N1	N1	N1
D3	N1wn	N1	N1/S3n	N1/S3n	N1/S3n	N1/S3
E	N1wn	S3-N1n	S3-N1n	S3-N1n	S3-N1n	N1

The above two tables are comparable but not entirely because the sowing dates in the first scenario differ from those in the second. The criteria for scenario 1 are almost equal to those used in BFSUIT. The spread of suitability classes is relatively wide. The spread for scenario 2 is narrow and differences between mapping units are not expressed as different classes but rather as different labels.

One reason for the differences is the incorporation into the simulation procedure of the variables 'gravel content' and 'rootable soil depth', which gave rise to a less favorable rating for water availability. However, the lower slopes receive more water because water as allowed to be spatially redistributed. By far the most important reason for the difference is in criteria for accounting for soil fertility. Striking is the sensitivity of the evaluation procedure to minor differences in rating criteria.

If the availability of time, labor and mineral fertilizers is adequate while the bio-physical availability of organic fertilizers is not a serious constraint, the majority of all legend units are 'moderately suitable' to 'marginally suitable' to 'unsuitable' for all crops. If the availability of time, labor and mineral fertilizers is relatively low while the bio-physical availability of organic fertilizers is seriously limited, the majority of all legend units are 'marginally suitable' to 'unsuitable' for all crops.

The range of suitability classes becomes narrower for scenario 2; some plausible tendencies are visible:

On the higher parts of the Anté-Birrimian toposequence (B1, B2) land suitability for crop production is limited by water availability and to a lesser extent by nutrient availability. Drainage conditions are often unfavorable as well on these plateaux. The upper and middle slopes (C2) have limiting nutrient and water availabilities whereas nutrient availability is the only limiting factor on the lower slopes (C3). In the valleys (D) 'risk of flooding', 'drainage' and 'nutrient availability' are the dominant limiting factors.

The suitability of the hilly area of the Birrimian toposequence (AC1) is only slightly limited by water and nutrient availabilities. Water is the main limiting factor on the plateaux and on the upper, middle and lower slopes. Occasionally 'nutrient availability' is also limiting on the upper and middle slopes.

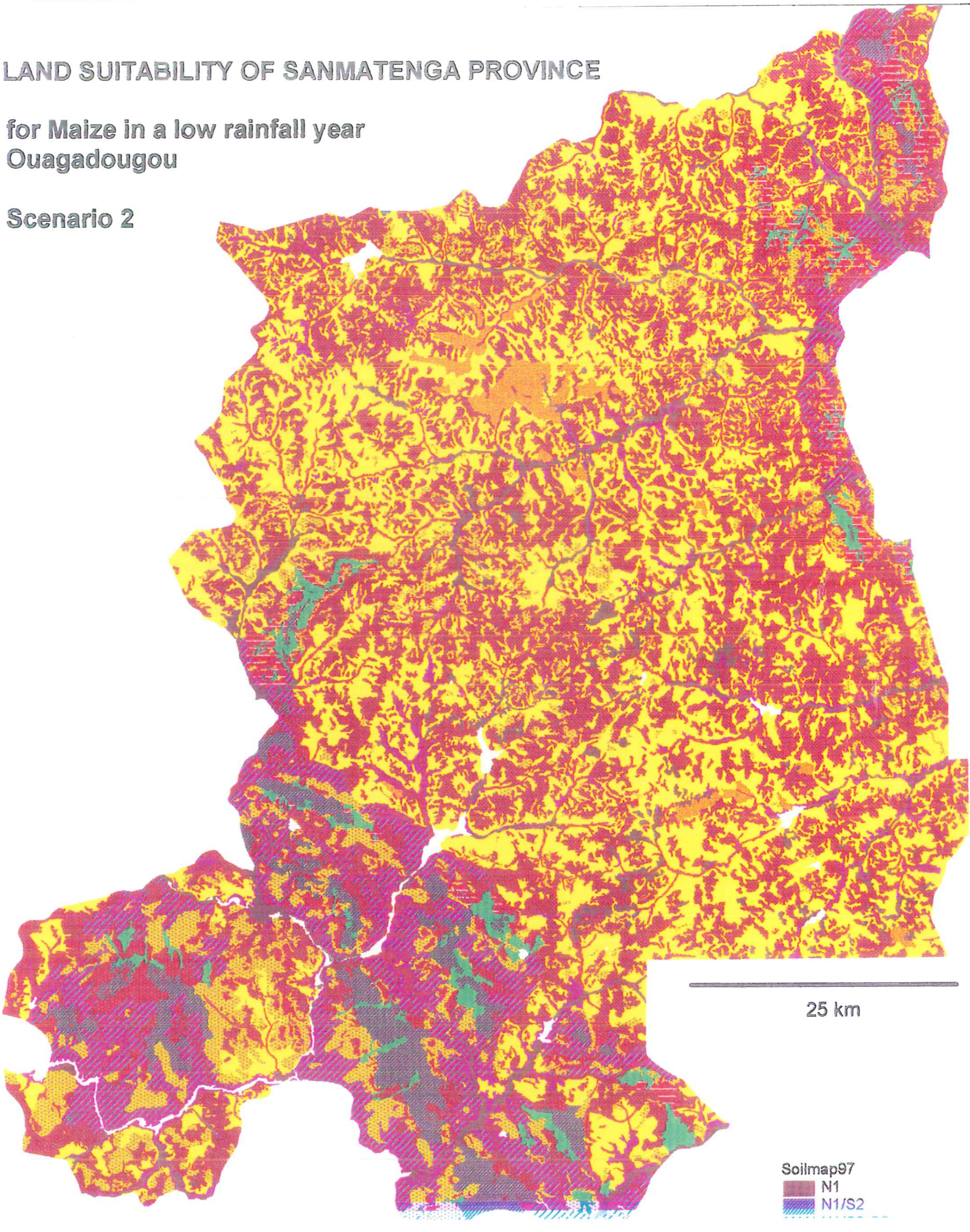
The above described tendencies are valid for all crops though minor differences remain. Millet is relatively sensitive to flooding and little sensitive to drought; rice thrives under poor drainage conditions, cowpea is less sensitive to low nutrient status but is sensitive to drought just as soybean, maize and groundnut.

The main conclusion is that the bio-physical suitability of Sanmatenga province for (sustainable) arable cropping depends on the question whether the bio-physical availability of organic fertilizers is sufficiently high to support adequate mineral fertilization.

LAND SUITABILITY OF SANMATENGA PROVINCE

for Maize in a low rainfall year
Ouagadougou

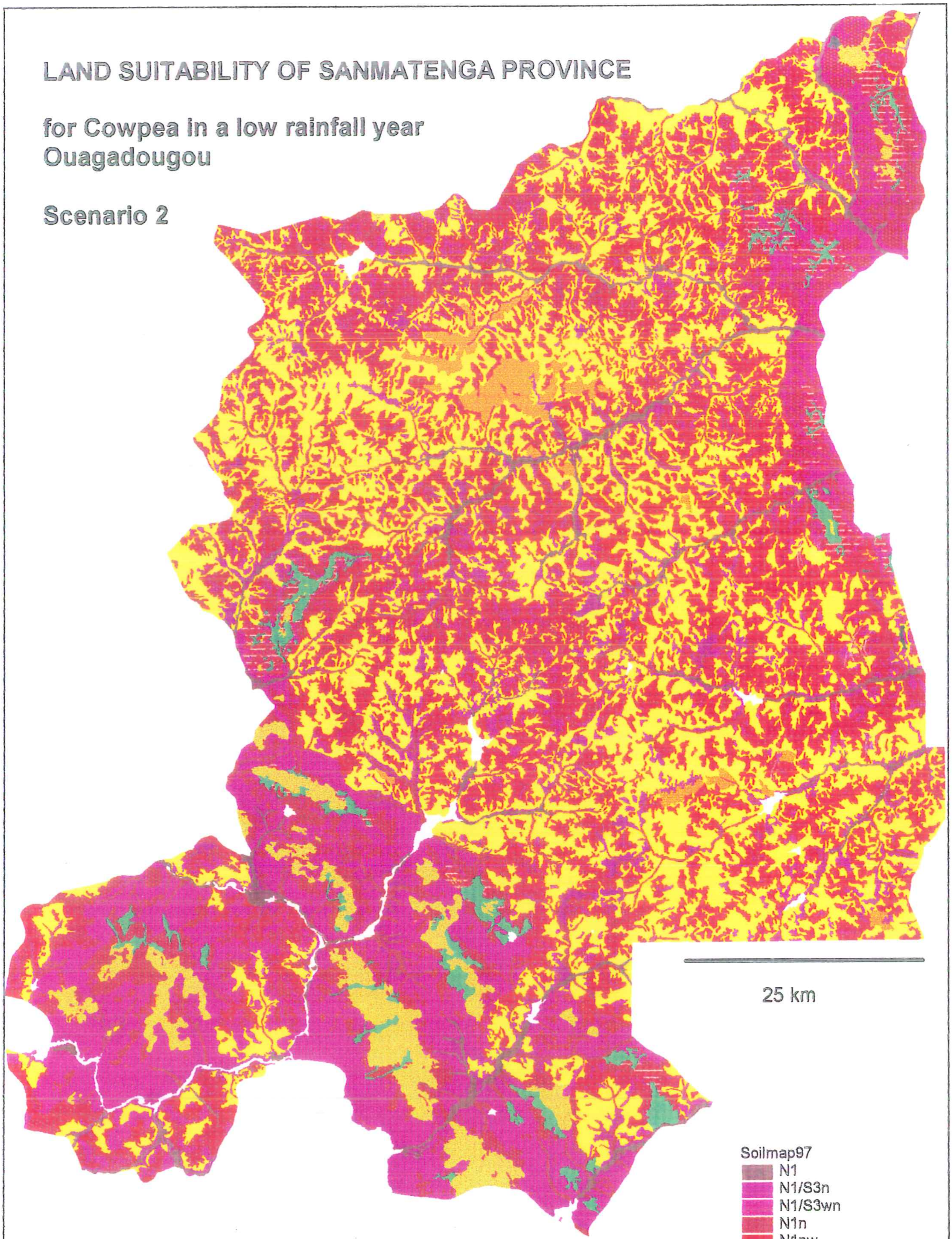
Scenario 2



LAND SUITABILITY OF SANMATENGA PROVINCE

for Cowpea in a low rainfall year
Ouagadougou

Scenario 2



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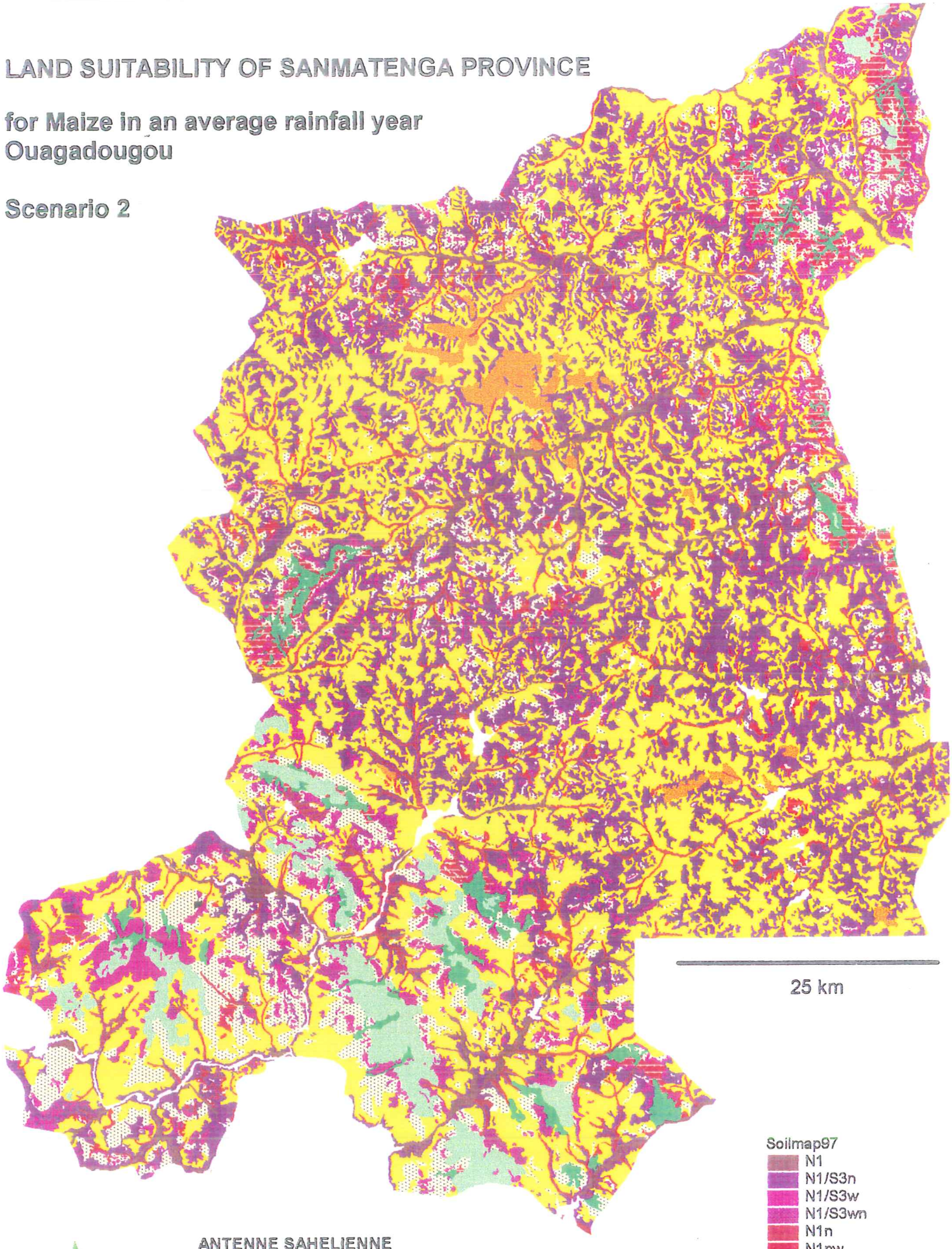
Wageningen, the Netherlands, 1998

Agricultural University Wageningen

LAND SUITABILITY OF SANMATENGA PROVINCE

for Maize in an average rainfall year Ouagadougou

Scenario 2



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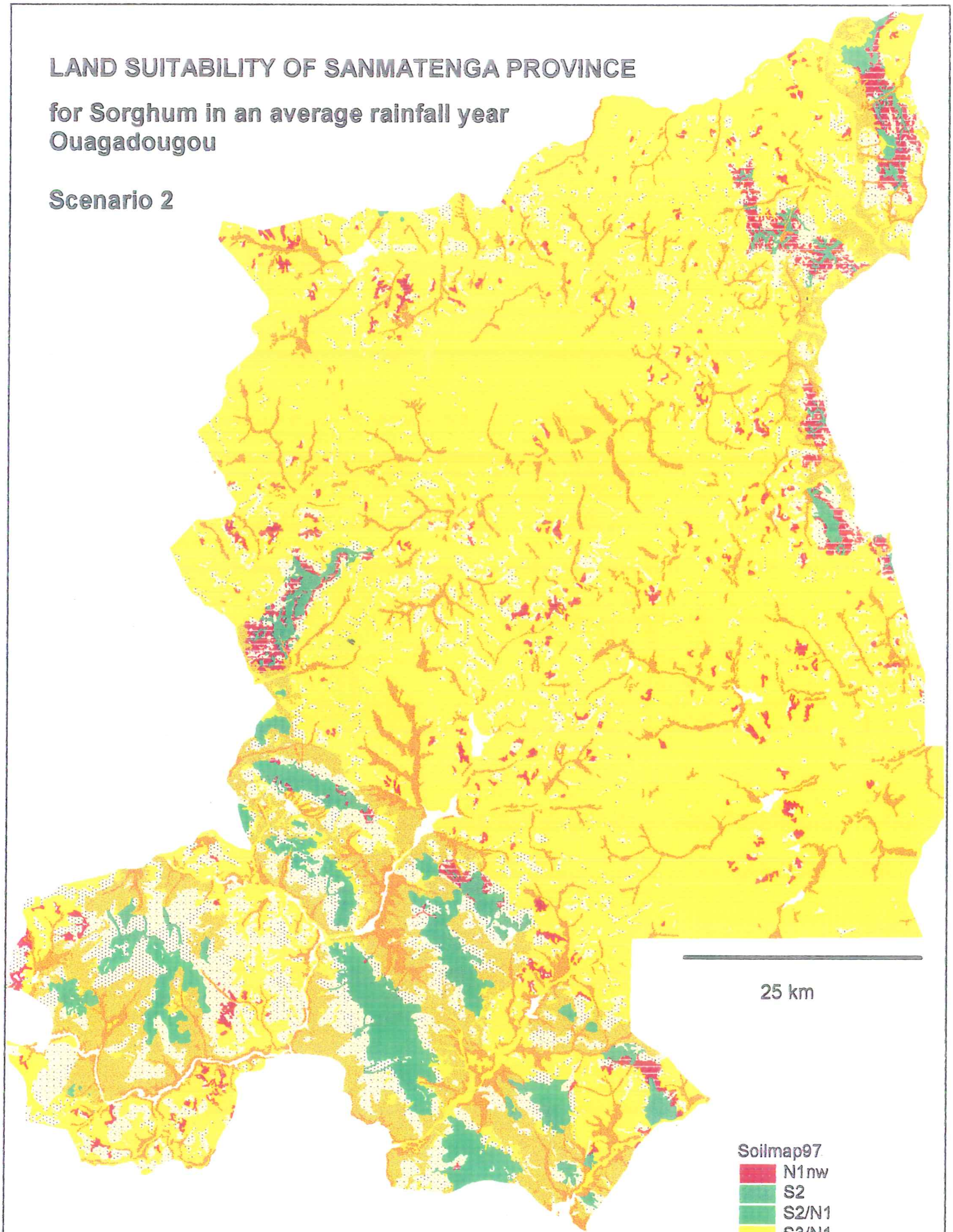
LAND SUITABILITY OF SANMATENGA PROVINCE

for Sorghum in an average rainfall year Ouagadougou

Scenario 2



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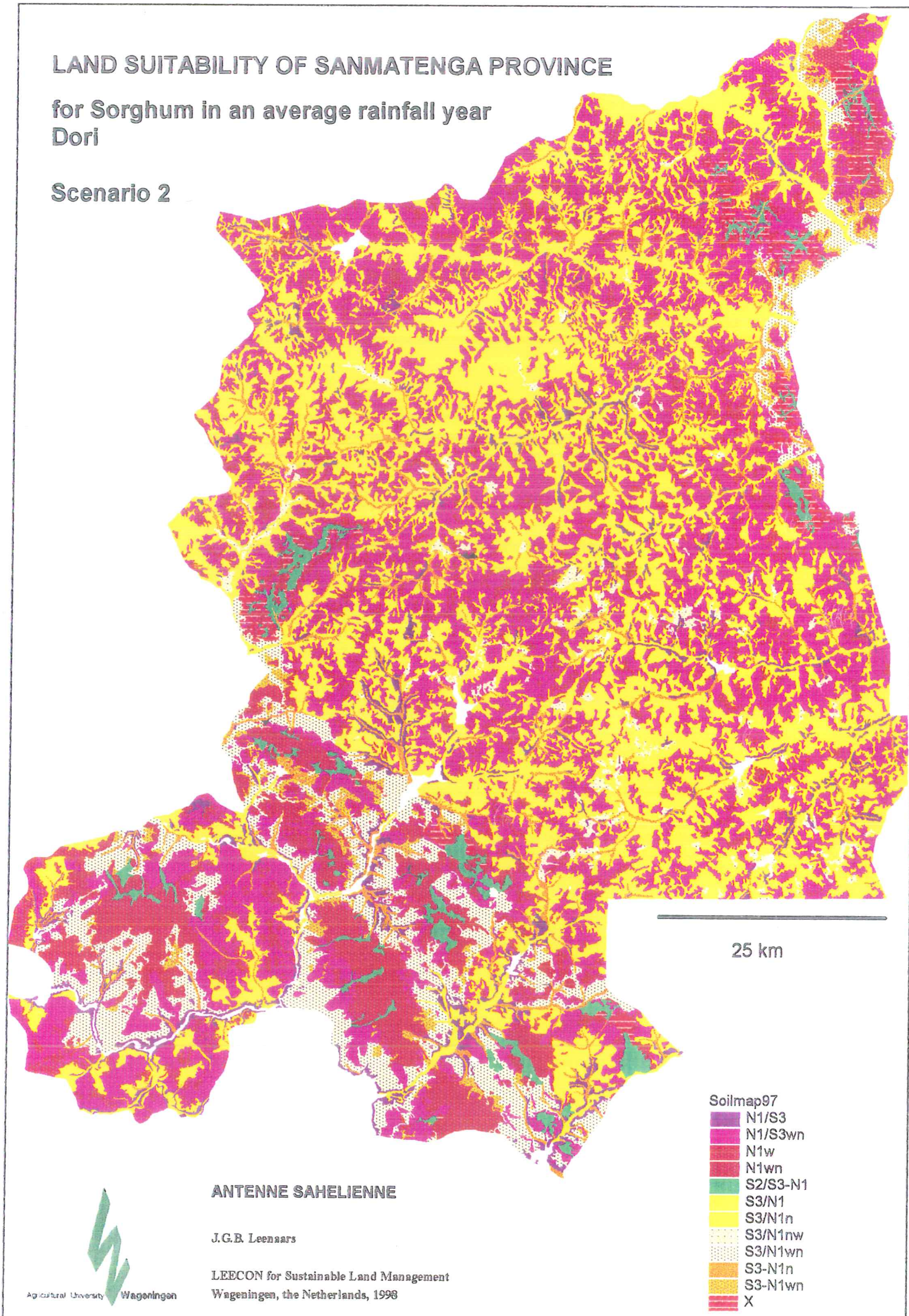
LAND SUITABILITY OF SANMATENGA PROVINCE

for Sorghum in an average rainfall year
Dori

Scenario 2



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6. DISCUSSION

Two scenarios were distinguished and evaluated. One scenario assumed sufficient availability of time, labor and mineral and organic fertilizers, the other insufficient availability of these. Despite the reconnaissance nature of the evaluation procedure and the limited number of management options considered, one may conclude that the soils of Sanmatenga province are marginally to moderately suitable for arable crop production given time and labor efficient management of (fertilizing) resources. However, the availability of (fertilizing) resources is such that in reality only a limited area can be moderately suitable. On which soils to apply the scarce resources?

Recently, a National Strategy for integrated management of soil fertility was adopted (1998). One striking objective is to increase the soil organic matter content of more than 60% of the cultivated land to the level of the so-called 'house fields'. Organic- and mineral fertilization are declared tools to do so.

The possibility to apply these tools is limited by erratic rainfall patterns, ultimately leading to financial risks. Soil characteristics determine whether fluctuations in humidity may be buffered and whether risk can be reduced. Coping with climatic variability can well be based on proper management of the soil diversity. The number of soil characteristics to be taken into account for correct indication of orders of magnitude is large but manageable. The same holds for management options.
The following exercise shows how modern techniques and participatory techniques can go together in sustainable rural development.

6.1 Towards a participatory suitability assessment for nutrient management in Sanmatenga province

Local soil naming

Research of soil fertility management should be based on a shared understanding of local soil conditions. Local soil names are effective focal points for sharing knowledge on soil management.

Correlating mapping units with traditional or local soil units was discussed in § 3.1. This correlation is given in annex 2.

The range of characteristics of these soils can be determined by soil mapping using decision rules for the classification of collected soil data. This approach was applied in the provinces of Sanmatenga and Zoundwéogo (Leenaars, 1998b). After characterization, the local soils can be evaluated as was done though not reported by Driessen, Ihle and Leenaars (1997). See annex 3 for the results.

Local water management practices

The currently practiced management is highly dynamic. However, it can be described rather accurately as a function of the interaction between current weather conditions and the availability of time and land, using the so-called village model (champs de case, de village et de brousse). Figure 3 confirms that crop management on the 'champs de case' or house fields, is concentrated during a short period with relatively secure rainfall. This reduces the risk of drought and justifies labor demanding management and extra inputs.

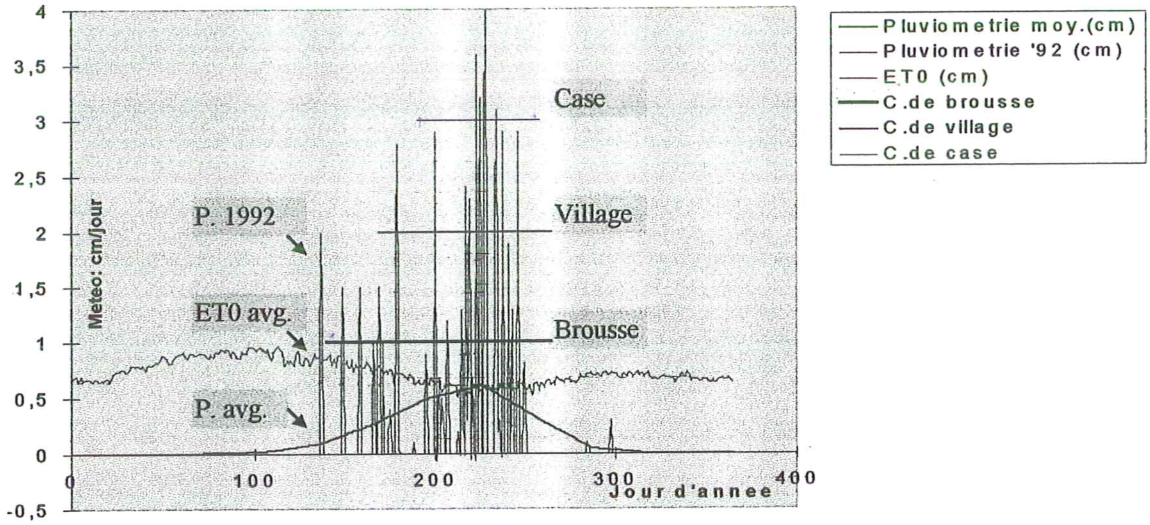


Figure 3. Time management according to the 'village model'; the sowing date and the variety choice are a function of the distance from the house, adaptable to the seasonal rainfall distribution (Dori; 1992 and 33-year average). Note the low but evenly distributed daily rainfall for the averaged weather data (P. avg.). (From Leenaars, 1998a).

Local nutrient management

Currently practiced management implies spatial redistribution of nutrients, cq. organic matter, and is illustrated in figure 4. High yields are obtained on the house fields even though these fields are commonly situated on gravelly soils (ferric regosols; zegedga) with low soil water retention capacity (Leenaars, 1998b).

The adopted National Strategy facilitates to strengthen this spatial nutrient management.

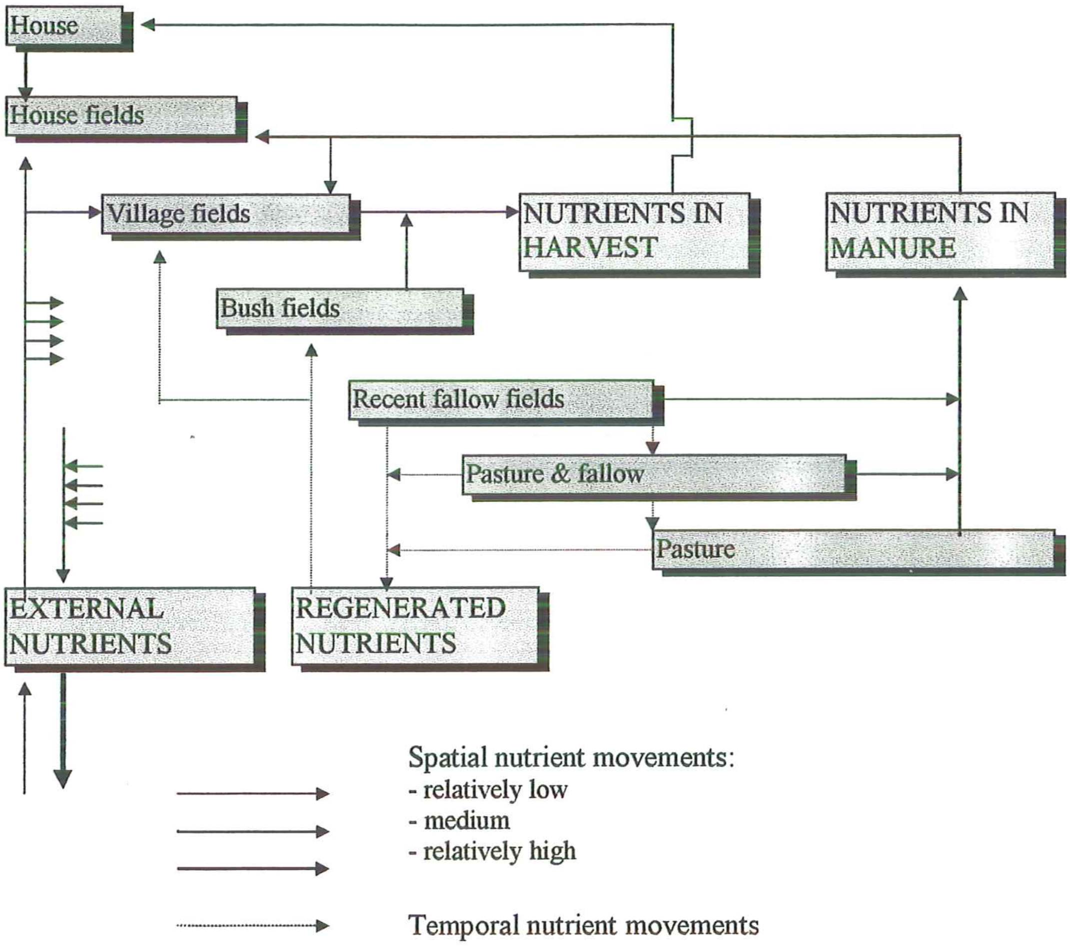


Figure 4. Currently practiced spatial and temporal nutrient management at local scale in Sanmatenga. The system has two sinks: outside losses and the house fields. (From Leenaars, 1998a)

External inputs and local decisions

The attainable yield depends on both water availability and on nutrient availability as is clearly illustrated by the following figure.

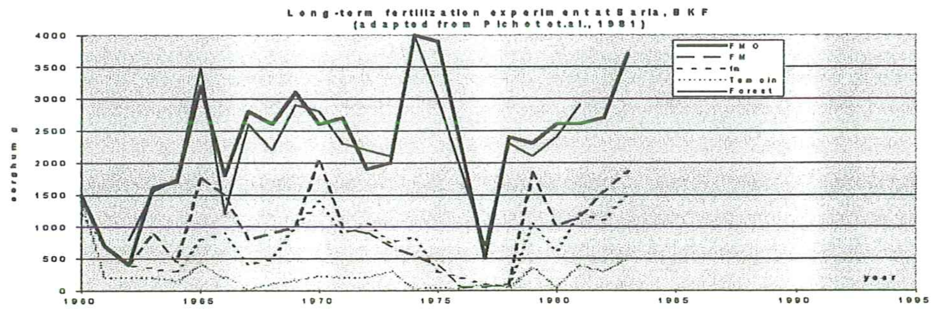


Fig. 5. Multi-year sorghum yields observed at Saria with corresponding weather conditions, fertilizer dose and fertilizer type (Pichot et.al., 1981). (Note the highest crop response to fertilization when combining organic ánd mineral fertilizers).

The yearly crop response to nutrient inputs depends strongly on the yearly water availability and thus on the drought buffering capacity of the soil. The multi-year response of sorghum to fertilizer applications was simulated for three 'local' soil types with different soil water holding capacities. The results are shown in figure 6 a, b & c.

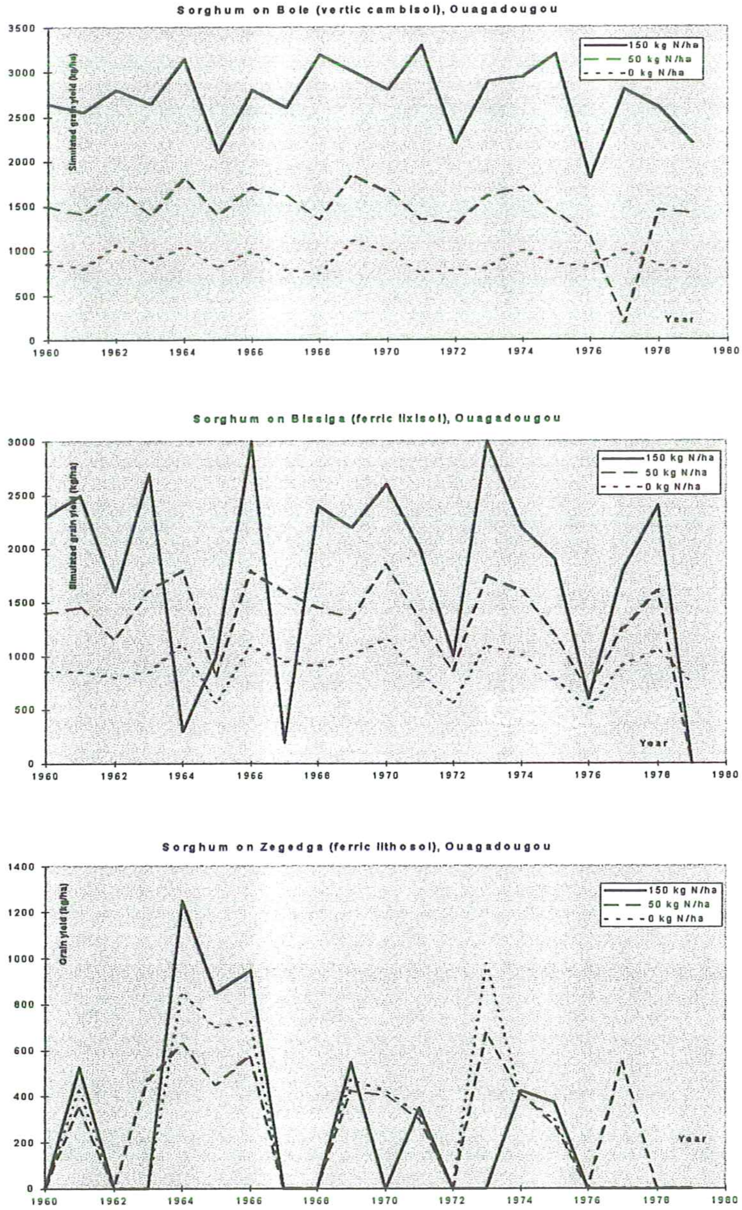
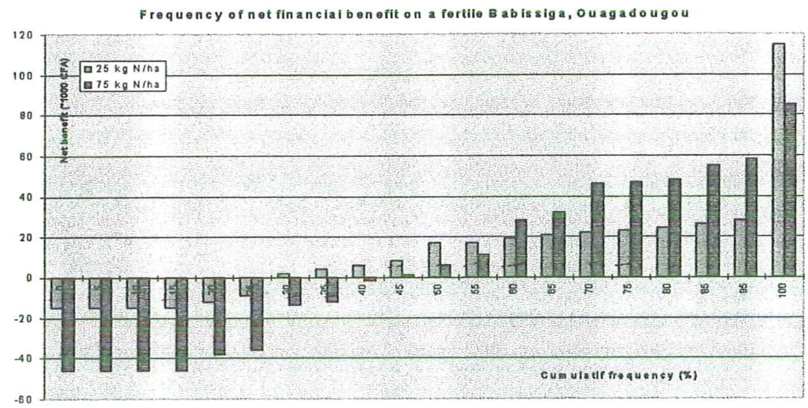


Figure 6 a, b & c. Simulated differences in yearly yield response to fertilizer application as a function of different water holding capacities (a: high; bolé, b: medium, bissiga, c: low; zegedga).

The response to fertilizer applications depends also on the inherent soil fertility. The effect of fertilizer inputs on the net farm budget was simulated for two situations with different inherent soil fertility; the result was expressed as one figure to enable it to be displayed on a map (figure 7 a & b).



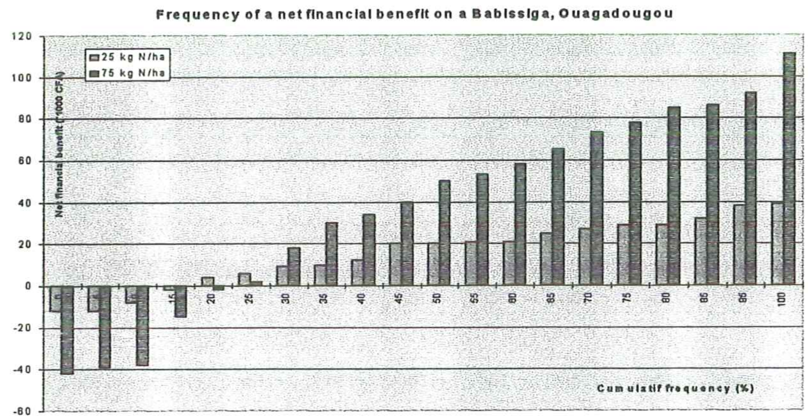


Figure 7. The frequencies of net financial benefit of fertilizer input on a fertile (a) and a not-fertile (b) babissiga.

Net financial gain through input of 75 kg N/ha was simulated to be achieved in 55% of all cases when applied on fertile babissiga and in 75% when applied on non-fertile babissiga soil. The procedure is comparable with the one as applied for figure 1.

Conclusion

Chapter 6 recommends to search for environmental indicators of general soil suitability and improved nutrient management that can be recognized by farmers in the region and have a practical meaning to them. An appropriate starting point is the currently applied management strategy, thereby exploiting trends and patterns in the local environmental conditions to minimize the risk of drought stress while maximizing total production.

The adopted National Strategy gives rise to the question whether the overall suitability of the region decreases or increases when (fertilizing) organic materials are mined at one place to be applied and concentrated at another place.

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Annex 1. Weather data converted from the CP-BKF3 format to the BFSUIT format.

Donnees meteorologiques de station de Dori, BKF, 1960 / 1992
(transformation de format des meteo-fiches du modele de simulation de croissance cerealiere CP-BKF3 (AB-DLO/Bunasols/Inera, 1995)
au format des meteo-fiches du modele de simulation de croissance des vegetaux agricoles PS123).
J.Leenaars 1996

CP-BKF3
-radiation (kJ/m2/jr)
-min.temperature (C)
-max.temperature (C)
-pression de vapeur de bon matin (kPa)
-vitesse moy. de vent (m/s)
-precipitation (mm/jr)

PS123
-max.temperature (C)
-min.temperature (C)
-precipitation (cm/jr)
-humidite relative d'atmosphere
pendant la journee (0-1)
-evaporation potentielle (cm/jr)
-duree d'insolation (h/jr)
-evapotranspiration potentielle (cm/jr)

1960 - 1968
* radiation jr 1-365: valeurs moyennes des autres années
* TMN jr 1-365: moyenne des autres années
* TMX jr 1-365: moyenne des autres années
* VAP jr 1-365: moyenne des autres années
* vent jr 1-365: moyenne des autres années
1969
* radiation jr 32-59,79-80,325-341: valeurs moyennes des autres années
* jour 154 RAD=2690: trop petit pour ATMTR, mis à 12690
* jour 245 RAD=980: trop petit pour ATMTR, mis à 11980
* jour 358 RAD=27920: trop grand pour ATMTR, mis à 20920
* TMN jr 325-341: valeurs moyennes des autres années
* TMX jr 326-341: valeurs moyennes des autres années
* VENT jr 325-341: valeurs moyennes des autres années
1970
* radiation jr 1-365: valeurs moyennes des autres années
* TMN jr 1-365: moyenne des autres années
* TMX jr 1-365: moyenne des autres années
* VAP jr 1-365: moyenne des autres années
* vent jr 1-365: moyenne des autres années
1971
* radiation jr 78-79: valeurs moyennes des autres années
1972
* radiation jr 91,230-231: valeurs moyennes des autres années
1973
* radiation jr 80-89: valeurs moyennes des autres années
1974
* radiation jr 309-317: valeurs moyennes des autres années
1975
* radiation jour 186 RAD=3050: trop petit pour ATMTR, mis à 13050
1976
* radiation jr 194-196,276: valeurs moyennes des autres années
* jour 109 RAD=1280: trop petit pour ATMTR, mis à 11280
* jour 129 RAD=2990: trop petit pour ATMTR, mis à 12990
* jour 219 RAD=3220: trop petit pour ATMTR, mis à 13220
* TMN jr 194-195: valeurs moyennes des autres années
* TMX jr 194-195: valeurs moyennes des autres années
* VENT jr 1-31,61-91,195-196: valeurs moyennes des autres années
* RAIN jr 195-196: marquantes, mis à 0.
1977
* radiation jr 127,192-201,282,341-343: valeurs moyennes des autres années
* TMN jr 192-202,342-434: valeurs moyennes des autres années
* TMX jr 192-201,342-343: valeurs moyennes des autres années
* VENT jr 192-201,244-273,342-343: valeurs moyennes des autres années
* RAIN jr 187,210: marquantes, remplacer par 0
* jr 192-201: marquantes, remplacer par 1978
1978
* radiation jr 15-16,215-216: valeurs moyennes des autres années
* jour 27 RAD=30940: trop grand pour ATMTR, mis à 20940
* jour 116 RAD=180: trop petit pour ATMTR, mis à 11280
* jour 211 RAD=1090: trop petit pour ATMTR, mis à 11090
* jour 260 RAD=2730: trop petit pour ATMTR, mis à 12730
1979
* radiation jr 32-59,79-80,325-341: valeurs moyennes des autres années
* jour 154 RAD=2690: trop petit pour ATMTR, mis à 12690
* jour 245 RAD=980: trop petit pour ATMTR, mis à 11980
* jour 358 RAD=27920: trop grand pour ATMTR, mis à 20920
* TMN jr 325-341: valeurs moyennes des autres années
* TMX jr 326-341: valeurs moyennes des autres années
* VENT jr 325-341: valeurs moyennes des autres années
1980
* radiation jr 7,60,121-130,218-220,288-291,309-310: val.moy.des aut. ann.
* jour 183 RAD=2510: trop petit pour ATMTR, mis à 12510
* jour 232 RAD=3770: trop petit pour ATMTR, mis à 13770
* jour 251 RAD=1790: trop petit pour ATMTR, mis à 11790
* jour 254 RAD=1810: trop petit pour ATMTR, mis à 11810
* TMN jr 7-8,119,122-130,218-220,288-291,310-311: idem
* TMX jr 7-8,119,122-130,218-220,288-290,309-310: idem
* VENT jr 7,32-60,122-127,218-220,289-290,310: idem
* RAIN jr 59-60: marquantes, mis à 0.
1981
* radiation jr 182-212,254-258,263-264,273-6-365: val.moy.des autres années
* jour 54 RAD=3310: trop petit pour ATMTR, mis à 13310
* jour 155 RAD=35920: trop grand pour ATMTR, mis à 25920
* jour 267 RAD=32590: trop grand pour ATMTR, mis à 22590
* TMN jr 182-212: valeurs moyennes des autres années
* TMX jr 182-212: valeurs moyennes des autres années
* VAP jr 182-212,221: valeurs moyennes des autres années
* VENT jr 182-212: valeurs moyennes des autres années
1982
* radiation jr 1-365: valeurs moyennes des autres années
* TMX jr 121: TMN(25.8)>TMX (21.0), TMX=31.0
* TMX jr 124: TMN(28.5)>TMX (23.0), TMX=33.0
1983
* radiation jr 1-365: valeurs moyennes des autres années
1984
* radiation jr 1-104,122-124: valeurs moyennes des autres années
* jour 119 RAD=2390: trop petit pour ATMTR, mis à 12390
* jour 121 RAD=2730: trop petit pour ATMTR, mis à 12730
* jour 125 RAD=3040: trop petit pour ATMTR, mis à 13040
* jour 131 RAD=2720: trop petit pour ATMTR, mis à 12720
1985
* radiation jr 21-365: valeurs moyennes des autres années
1986
* radiation jr 1-123: valeurs moyennes des autres années
* jour 170 RAD=960: trop petit pour ATMTR, mis à 11960
* jour 188 RAD=2130: trop petit pour ATMTR, mis à 12130
1987
* radiation jr 125-127: valeurs moyennes des autres années
* jour 271 RAD=70: trop petit pour ATMTR, mis à 11070
1988
* VAP jr 1-365: valeurs moyennes des autres années
* jour 96 RAD=50: trop petit, mis à 11050
* jour 116 RAD=3370: trop petit pour ATMTR, mis à 13370
* jour 192 RAD=740: trop petit, mis à 11740
* jour 193 RAD=30: trop petit, mis à 11030
* jour 235 RAD=3210: trop petit pour ATMTR, mis à 13210
* jour 243 RAD=1810: trop petit, mis à 11810
1989
* radiation jr 103: valeurs moyennes des autres années
* jr 269 RAD=1480: trop petit, mis à 11480
* VAP jr 1-365: valeurs moyennes des autres années
1990
* radiation jr 364: valeurs moyennes des autres années
* jr 278 RAD=570: trop petit, mis à 11570
* jr 279 RAD=800: trop petit, mis à 11800
1991 - 1992
* radiation jr 1-365: valeurs moyennes des autres années
* TMN jr 1-365: valeurs moyennes des autres années
* TMX jr 1-365: valeurs moyennes des autres années
* VAP jr 1-365: valeurs moyennes des autres années
* VENT jr 1-365: valeurs moyennes des autres années
*
multi year average (DORI.DAT)
* radiation jr 1-365: valeurs moyennes des autres années
* TMN jr 1-365: valeurs moyennes des autres années
* TMX jr 1-365: valeurs moyennes des autres années
* VAP jr 1-365: valeurs moyennes des autres années
* VENT jr 1-365: valeurs moyennes des autres années
* PREC jr 1-365: valeurs moyennes des autres années
* valeurs journalieres moyennes de DORI.DAT resultat
d'interpolation lineaire des valeurs mensuelles moyennes

Donnees meteorologiques de station de Ouagadougou, BKF, 1960 / 1992

(transformation du format des meteo-fiches du modele de simulation de croissance cerealiere CP-BKF3 (AB-DLO/Bunasols/Inera, 1995)
au format des meteo-fiches du modele de simulation de croissance des vegetaux agricoles PS123).

J. Leenaars 1996

CP-BKF3	PS123
-radiation (kJ/m2/jr)	-max.temperature (C)
-min.temperature (C)	-min.temperature (C)
-max.temperature (C)	-precipitation (cm/jr)
-pression de vapeur de bon matin (kPa)	-humidite relative d'atmosphere pendant la journee (0-1)
-vitesse moy. de vent (m/s)	-evaporation potentielle (cm/jr)
-precipitation (mm/jr)	-duree d'insolation (h/jr)
	-evapotranspiration potentielle (cm/jr)

les données du 1 janvier au 31 mars et du 1 novembre au 31 décembre de tous annees sont les valeurs moyennes sauf de la pluviometrie !

1960
* radiation 1960: valeurs moyennes des autres années
* vent 1960: moyenne des autres années

1961 - 1965
* radiation valeurs moyennes des autres années

1966
* radiation 1966: valeurs moyennes des autres années
* température jr120 TMN=22.0 TMX=26.8: mis aux valeurs moyennes
* température jr156 TMN=19.6 TMX=28.5: mis aux valeurs moyennes

1967 - 1969
* radiation valeurs moyennes des autres années

1970
* radiation 1970, jour 91-273: valeurs moyennes des autres années
* vent 1970: valeurs moyennes des autres années

1971
* radiation 1971, jour 194-214: valeurs moyennes des autres années

1972
* radiation jour 277-278: valeurs moyennes des autres années
* jour 174 RAD=2750: trop petit pour ATMTR, mis à 12750
* jour 226 RAD=1800: trop petit pour ATMTR, mis à 11800
* jour 254 RAD=610: trop petit pour ATMTR, mis à 11610

1973
* radiation 1970, jour 163: valeur moyenne des autres années

1974 - 1975
*

1976
* radiation jour 257-258: valeurs moyennes des autres années
* jour 129 RAD=3800: trop petit pour ATMTR, mis à 13800

1977
* radiation 1977, jour 192-202: valeurs moyennes des autres années
* TMMN,TMMX,VENT 1977, jour 192-201: valeurs moyennes des autres années
* RAIN 1977, jour 192-201: marquant, remplacer par 1978

1978 - 1979
* radiation 1978, jour 91-301: valeurs moyennes des autres années

1980
* radiation jour 119-131,218-221,288-291,297-305: val.moy.autres années
* TMMN jour 119-131,218-221,288: val.moy.autres années
* TMMX jour 119-130,218-220: val.moy.autres années
* VENT jour 119-130,219-220: val.moy.autres années
* RAIN 1977, jour 59-60: marquant, mis à 0.

1981
*

1982
* radiation 1982 jour 191-304: valeurs moyennes des autres années
* vent 1982 jour 182-212: valeurs moyennes des autres années

1983
* radiation jour 217-274: valeurs moyennes des autres années
* jour 134 RAD=3800: trop petit pour ATMTR, mis à 13800
* jour 152 RAD=2900: trop petit pour ATMTR, mis à 12900
* TMMX jour 222,225,231: valeurs moyennes des autres années

1984
* RAIN 1984, jour 59-60: marquante, mis à 0.

1985
* radiation jour 192 RAD=3430: trop petit pour ATMTR, mis à 13430
* jour 210 RAD=3620: trop petit pour ATMTR, mis à 13620
* vent 1985: valeurs moyennes des autres années

1986
* radiation jour 248 RAD=3630: trop petit pour ATMTR, mis à 13630

1987
*

1988
* radiation jour 95 RAD=3750: trop petit pour ATMTR, mis à 13750

1989
*

1990
* radiation jour 108-110: valeurs moyennes des autres années

1991 - 1992
* RAD,TMMN,TMMX,VAP, VENT: données moyennes des autres années

multi year average (OUAGADOUGOU.DAT)
* les données du 1 janvier au 31 décembre de cette annee moyenne sont
* resultat d'interpolation lineaire des données mensuelles moyennes,
* la pluviometrie inclue !

Annex 2. Correlation between map units and local soil names

French naming		Geology	DLO	WAU
Relief residuel		Birrimian	Rr	AC1, B1
		Ante-birrimian		B1
Surface fonctionelle;	glacis pente sup.	Birrimian	Gps	B2
		Ante-birrimian		B2
	glacis pente moy.	Birrimian	Gpm	C21, C22
		Ante-birrimian		C41, C42
	glacis pente inf.	Birrimian	Gpi	C31, C32
		Ante-birrimian		C51, C52
Plaine alluviale			Pa	D1, D2, D3
Complex eolienne			-	E

Ante-Birrimian	Rr	Gps	Gpm	Gpi	Pa
Tanga	31	1	0	0	0
Rassempouega	2	2	0	0	0
Zegedga	56	36	14	2	0
Batanga	3	1	1	1	0
Bissiga	6	37	72	57	10
Bole	0	1	4	3	1
Tafga	0	17	1	7	12
Zipele	0	3	6	17	2
Baongo	0	0	1	5	40
Kouiliga	2	2	1	9	35
	100%	100%	100%	100%	100%

Birrimian	Rr	Gps	Gpm	Gpi	Pa
Tanga	59	4	0	0	0
Rassempouega	4	8	0	0	0
Zegedga	18	27	9	1	0
Batanga	16	16	12	7	2
Bissiga	2	32	55	44	7
Bole	0	4	15	9	3
Tafga	0	5	0	2	2
Zipele	0	4	1	20	2
Baongo	0	0	1	10	60
Kouiliga	1	2	7	7	23
	100%	100%	100%	100%	100%

Annex 4. Reported data on productivity gathered in Sanmatenga province

Measured average economic productivity (kg /ha) for six crops in different years in Sanmatenga. (Standard deviations are within the orders of magnitude of the averages)

	1987/88	1988/89	1989/90	1990/91	1991/92	1993/94
Millet	300	780	375	420	670	680
Sorghum	330	700	470	370	880	590
Maize	150	1440	600	1200	500	520
Rice	3500	-	4230	5400	3900	4000
Groundnut	320	400	590	630	550	600
Cowpea	-	-	285	150	290	300

Reported sowing dates of cereals in 1993/94 as a function of site

1993/94	north	north	center	south
Millet	190-200	201-218	187	180-202
Sorghum		162-200	172-195	180-196

Reported response to superficial soil tillage (scarifiage).
+ significant, - not significant

	1989/90	1990/91	1991/92	1992/93	1993/94
Millet	+	+	+	+	+
Sorghum	+	-	+	+	-

Reported response of sorghum to the application of organic matter (kg /ha)

Sorghum	0	5000	7500	10000
1991/92	440	610	600	910
1992/93	490	740	970	1090

Reported response of cereals to the application of compost (kg /ha)

1991/92	0	5000
Millet	350	540
Sorghum	950	1360

Reported response of sorghum and soybean to different fertilizer types

	Sorghum	Soybean
0	365	125
NPK + urea + K	1400	-
NPK + urea	1700	420
Org.Mat. + urea + B.phosphate	2640	410
B.phosphate	-	320

Percentage of exploitations in Sanmatenga investing in agricultural measures (Barning & Dambré, 1994)

Manure / compost (5 ton /ha)	24 %
Production of compost	32 %
Fertilizers	13 %
Buy of animals	23 %
Buy of food for animals	55 %
Animal traction	27 % (area)
Mulching	65 %
Anti-erosive measures	38 %

Measured average cereal grain response to the application of 45 kg N /ha and/or 90 kg P2O5 /ha (1991). (J.G.B. Leenaars & G. Dijksterhuis, 1992)

Bissiga	0/0	N/0	0/P	N/P
Dori (milet)	500	600	600	900
Kaya (millet)	700	900	1000	1400
Ouaga (millet)	1800	2800	2800	3400

Bole	0/0	N/0	0/P	N/P
Dori (millet)	1400	1600	1700	1700
Kaya (sorghum)	2000	2000	2000	2700

Baongo	0/0
Kaya (sorghum)	3100
Ouaga (sorghum)	4000

Reported average productivity (kg /ha) for some crops as a function of terrain type and administrative sector (dept. of agronomic statistics).

Red sorghum	Kaya	Korsimoro	Mane	Kongoussi	All
Valley soils	1839	1212	608	742	1100
Slope soils (house & village fields)	871	1066	1253	1054	1061
Slope soils (bush fields)	498	1022	860	36	604
Upper slopes	383	1030	458	904	694
White sorghum					
Valley soils	702	945	669	697	753
Slope soils (house & village fields)	936	756	766	937	849
Slope soils (bush fields)	513	946	54	691	551
Upper slopes	522	1249	510	1441	931
Millet					
Valley soils	536	789	340	399	516
Slope soils (house & village fields)	479	562	498	663	551
Slope soils (bush fields)	400	672	417	432	480
Upper slopes	337	770	746	482	584
Groundnuts					
Valley soils	149	350	316	659	369
Slope soils (house & village fields)	871	1770	491	658	948
Slope soils (bush fields)	730	2470	460	645	1076
Upper slopes	1229	2732	599	503	1266
Cowpea					
Valley soils	316 -		299	409	341
Slope soils (house & village fields)	364	536	316	378	399
Slope soils (bush fields)	328	977	361	373	510
Upper slopes	309	997	819	381	627
Rice					
Valley soils	3269	1147	13	457	1222
Slope soils (house & village fields)				1754	1754

Legend to annex 5.

MAPCODE$ is the mapping unit (bold)
CLASS$ are the suitability classes of all individual observation points per mapping unit
YLD2AGGR is the simulated attainable yield (kg /ha) aggregated for each mapping unit and indicated in the last column (bold)

Suitability classes:

S1	suitable
S2	moderately suitable
S3	marginally suitable
N1	currently not suitable
N2	permanently not suitable

Labels of land qualities with a rating of 4 or 5:

w.	water availability
n.	nutrient availability
d.	oxygen availability
e.	impact of erosion
f.	risk of flooding
r.	workability
c.	impact of surface crust

In some cases you'll see attainable yields aggregated per mapping unit calculated to be very low, while suitability classes are not labeled for limiting water availability. This may occur only when the bio-physical yield potential also was very low or when the labeling was incorrect. This is verified and the labeling procedure is corrected.

Annex 5. Suitability classes for seven crops, two stations and three years with different rainfall regime. Scenario 1.

MIL DORI DRY

MAPCODE$ CLASS$ YLD2AGGR

AC1 N1w, S1, N1nr, N1nr, S2, S3n, S2, S1, S2 **6**

B1 S3r, N1f, N1wd, N1w, N1df **2**

B2 N1w, S3n, S3n, S3n, S3n, S3n, S3n, S3dn, N1dn, S3n, N1dn, S3n **6**

C21 S3ne, N1nre, N1ne, N1ne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1dnef, N1dne **6**

C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1n, N1n, N1n, N1n, S3n, S3n, N1df, N1dnf **6**

C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **6**

C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, S3n, S3n, S3n, S2, S2, S2, S2 **6**

C41 N1e, N1ef, S3e, S3re **5**

C42 N1r, S2, S2, S3, S2, S2, S2, S2, S2, N1d, N1w, S2, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **6**

C51 X **0**

C52 S2, N1f, S2, S2, S2, S2, S2, S2, S2 **6**

D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **6**

D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **6**

D3 N1ncf, N1dnrf, S3n **4**

E S3n, N1nf, N1dnrf, S3n **5**

MIL DORI MEDIUM

MAPCODE$ CLASS$ YLD2AGGR

AC1 N1w, S3w, N1wnr, N1wnr, S3w, S3n, S3w, S3w, S3w **590**

B1 S3wr, N1wf, N1wd, S3w, N1df **409**

B2 N1w, N1wn, S3wn, S3wn, S3wn, S3wn, S3wn, N1wdn, N1wdn, S3wn, N1wdn, S3wn **545**

C21 S3wne, N1wnre, N1ne, N1ne, N1dnef, N1ne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **662**

C22 S3nc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1nc, S3w, S3n, N1nr, S3n, N1wn, N1wn, N1wn, N1wn, S3wn, S3n, N1wdf, N1dnf **705**

C31 N1wref, N1wdecf, N1re, S3wne, S3e, S3we, N1drecf, N1de **898**

C32 S3r, S3wn, N1f, S3w, N1dcf, N1wdc, S3c, S2, N1c, S3w, S3w, N1w, S3w, S3, N1r, N1wdrf, S2, S2, N1r, N1, S3r, S3w, N1wf, N1wnrf, S3w, S3w, S2, S3w, S3w, S3n, S3wn, S3n, S2, S3, S2, N1w **942**

C41 N1e, N1wef, S3e, S3wre **644**

C42 N1r, S2, N1w, S3w, S3w, N1w, N1w, S2, S2, N1wd, S3w, S2, S3w, N1wdf, S3w, N1wdf, S2, N1-c, N1f, S2, S2, S3w, S3w, N1df, N1w **826**

C51 X **0**

C52 S3, N1wf, S3w, S2, S3w, S3w, S3w, S3w, S2 **657**

D1 N1wn, S3wn, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1wdf, N1rf, N1wrf **1105**

D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1wf, N1f, N1df, N1df, N1f-c **1279**

D3 N1wncf, N1dnrf, S3wn **765**

E S3wn, N1nf, N1dnrf, S3wn **821**

MIL DORI WET

MAPCODE$ CLASS$ YLD2AGGR

AC1 S2, S1, N1nr, N1nr, S2, S3n, S2, S1, S2 **1738**

B1 S3r, N1wf, N1wd, N1w, N1df **421**

B2 N1w, S3n, S3wn, N1wn, S3n, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **974**

C21 S3ne, N1nre, N1ne, N1ne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1wdnecf, N1wnef, N1dnef, N1dne **1694**

C22 S3nc, N1nr, S3n, S3n, S3wn, N1wn, N1nc, S3, S3wn, N1nr, S3wn, N1n, N1n, N1n, N1n, S3wn, S3wn, N1df, N1dnf **1732**

C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2177**

C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, S3n, N1wn, S3n, S2, S3w, S2, S2 **2229**

C41 N1e, N1ef, S3e, S3re **1400**

C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1wd, N1w, S2, S2, N1df, N1w, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **1908**

C51 X **0**

C52 S2, N1f, N1w, S2, S2, N1w, S2, S2, S2 **1669**

D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2317**

D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2352**

D3 N1ncf, N1dnrf, S3n **1509**

E S3n, N1nf, N1dnrf, S3n **1914**

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MIL OUAGA DRY

MAPCODE$ CLASS$ YLD2AGGR

AC1 S2, S1, N1nr, N1nr, S2, S3n, S3w, S1, S2 **927**

B1 S3r, N1wf, N1wd, N1w, N1df **279**
B2 N1w, S3n, S3n, N1wn, S3n, S3n, S3n, N1wdn, N1dn, S3n, N1wdn, S3n **635**
C21 S3ne, N1nre, N1ne, N1ne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1wnef, N1dnef, N1dne **1134**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1wn, N1n, N1n, N1n, S3n, S3n, N1df, N1dnf **1179**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **1334**
C32 S3r, S3wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, S3n, S3n, S3n, S2, S2, S2, S2 **1418**
C41 N1e, N1ef, S3e, S3re **948**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1d, N1w, S2, S2, N1df, S3w, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **1202**
C51 X **0**
C52 S2, N1f, S2, S2, S2, S2, S2, S2, S2 **1181**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **1437**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **1432**
D3 N1ncf, N1dnrf, S3n **701**
E S3n, N1nf, N1dnrf, S3n **1178**

MIL OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, S2, S3n, S2, S1, S2 **1799**
B1 S3r, N1wf, N1wd, N1w, N1df **400**
B2 N1w, S3n, S3n, N1wn, S3n, S3n, S3n, N1wdn, N1dn, S3n, N1wdn, S3n **1066**
C21 S3wne, N1nre, N1ne, N1ne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1dnef, N1dne **1884**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1n, N1n, N1n, N1n, S3wn, S3n, N1df, N1dnf **1742**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **1821**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, S2, S3n, S3wn, S3n, S2, S2, S2, S2 **1948**
C41 N1e, N1ef, S3e, S3re **1462**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1d, N1w, S2, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **1786**
C51 X **0**
C52 S2, N1f, S3w, S2, S2, S2, S2, S2, S2 **1700**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **1963**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **1963**
D3 N1ncf, N1dnrf, S3n **1430**
E S3n, N1nf, N1dnrf, S3n **1618**

MIL OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, S2, S3n, S2, S1, S2 **1748**
B1 S3r, N1wf, N1wd, N1w, N1df **452**
B2 N1w, S3n, S3n, N1wn, S3n, S3n, S3n, N1wdn, N1dn, S3n, N1wdn, S3n **1053**
C21 S3ne, N1nre, N1ne, N1ne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1wnef, N1dnef, N1dne **1761**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1n, N1n, N1n, N1n, S3n, S3n, N1df, N1dnf **1702**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2026**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, S3n, S3wn, S3n, S2, S3, S2, S2 **2165**
C41 N1e, N1ef, S3e, S3re **1486**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1d, S3w, S2, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **1813**
C51 X **0**
C52 S2, N1f, S3w, S2, S2, S2, S2, S2, S2 **1691**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2163**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2188**
D3 N1ncf, N1dnrf, S3n **1520**
E S3n, N1nf, N1dnrf, S3n **1799**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1wnr, N1wnr, N1w, S2, S3w, N1w, N1w **591**
B1 N1wr, N1w, N1wd, N1w, S3d **231**
B2 N1w, S3n, N1w, N1w, N1wn, S3n, N1w, N1wd, N1wdn, N1wn, N1wdn, S3wn **250**
C21 S3wne, N1wnre, N1wne, N1wne, N1dne, N1wne, N1nre, N1wnre, N1ne, N1wdnec, N1wne, N1wdne, N1wdne **547**
C22 N1wnc, N1wnr, S3n, S3n, N1wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1wn, N1n, N1wn, N1n, N1wn, N1wn, S3d, S3dn **679**

D3 S3nc, N1dnr, S3n **1590**
E S3n, S3n, N1dnr, S3n **1626**

SORGHO OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, S2, S2, S2, S1, S2 **2235**
B1 S3r, N1w, N1wd, N1w, S3d **518**
B2 N1w, S3n, S2, N1w, S3n, S3n, S2, N1wd, S3dn, S3n, N1wdn, S3n **1565**
C21 S3wne, N1nre, N1ne, N1ne, N1dne, N1ne, N1nre, N1nre, N1ne, N1dnec, N1ne, N1dne, N1dne **2169**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1n, N1n, N1n, N1n, S3wn, S3n, S3d, S3dn **2066**
C31 N1re, N1dec, N1re, S3ne, S3e, S3e, N1drec, S3de **2344**
C32 S3r, S3n, N1, S2, N1dc, S3dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1dr, S2, S2, N1r, N1, S3r, S3, S3, N1wnr, S3, S2, S2, S2, S2, S3n, N1wn, S3n, S2, S2, S2, S2 **2534**
C41 N1e, S3e, S3e, S3re **1998**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, S3d, N1w, S2, S2, S3d, S2, S3d, S2, N1-c, S2, S2, S2, S2, S1, S3d, S2 **2321**
C51 X **0**
C52 S2, S2, S2, S2, S2, S2, S2, S2, S2 **2219**
D1 N1n, S3n, N1dnr, S3dc, S3dc, N1dc, S2, S3d, N1r, N1r **2478**
D2 N1dr, N1r, S3r, N1dr, N1r, S2, S3, S3d, S3d, S2-c **2552**
D3 S3nc, N1dnr, S3n **1894**
E S3n, S3n, N1dnr, S3n **2070**

SORGHO OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, S3w, S2, S2, S3w, S2 **2107**
B1 S3r, N1w, N1wd, N1w, S3d **593**
B2 N1w, S3n, S2, N1w, S3n, S3n, S2, N1wd, S3wdn, S3n, N1wdn, S3n **1390**
C21 S3ne, N1nre, N1ne, N1wne, N1dne, N1ne, N1nre, N1nre, N1ne, N1dnec, N1wne, N1dne, N1dne **2211**
C22 S3nc, N1wnr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3wn, N1n, N1n, N1n, N1n, S3n, S3wn, S3d, S3dn **2115**
C31 N1re, N1dec, N1re, S3ne, S3e, S3e, N1drec, S3de **2531**
C32 S3r, S3n, N1, S2, N1dc, S3dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1dr, S2, S2, N1r, N1, S3r, S3, S3, N1nr, S3, S2, S2, S2, S2, S3n, N1wn, S3n, S2, S3w, S2, S2 **2717**
C41 N1e, S3e, S3e, S3re **1973**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, S3wd, N1w, S2, S2, S3d, S2, S3d, S2, N1-c, S2, S2, S2, S2, S1, S3d, S2 **2251**
C51 X **0**
C52 S2, S2, S2, S2, S2, S2, S2, S2, S2 **2289**
D1 N1n, S3n, N1dnr, S3dc, S3dc, N1dc, S2, S3d, N1r, N1r **2743**
D2 N1dr, N1r, S3r, N1dr, N1r, S2, S3, S3d, S3d, S2-c **2739**
D3 S3nc, N1dnr, S3n **1435**
E S3n, S3n, N1dnr, S3n **2218**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1wnr, N1w, N1wn, N1w, N1w, N1w **283**
B1 N1wr, N1wf, N1wd, N1w, N1wdf **0**
B2 N1w, N1wn, N1wn, N1wn, N1wn, S3wn, N1wn, N1wdn, N1wdn, N1wn, N1wdn, N1wn **169**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **273**
C22 N1wnc, N1wnr, S3wn, S3wn, N1wn, N1wn, N1wnc, S3w, N1wn, N1wnr, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wdf, N1wdnf **429**
C31 N1wref, N1wdecf, N1wre, S3wne, S3we, S3e, N1wdrecf, N1wde **517**
C32 N1wr, N1wn, N1f, S3w, N1wdcf, N1wdc, N1wc, S3w, N1wc, S3w, S3w, N1w, S3w, S3w, N1wr, N1wdrf, S3w, N1w, N1wr, N1w, S3wr, S3w, N1wf, N1wnrf, S3w, S3w, S2, S3w, N1w, N1wn, N1wn, N1wn, N1w, N1w, N1w, N1w **486**
C41 N1we, N1wef, N1we, N1wre **154**
C42 N1wr, N1w, N1w, S3w, S3w, N1w, N1w, S3w, N1w, N1wd, N1w, N1w, S3w, N1wdf, N1w, N1wdf, S2, N1w-c, N1wf, N1w, N1w, S3w, N1w, N1wdf, N1w **362**
C51 X **0**
C52 N1w, N1wf, N1w, N1w, N1w, N1w, S3w, S3w, N1w **312**
D1 N1wn, S3wn, N1wdnrf, N1wdcf, N1wdcf, N1wdcf, N1wf, N1wdf, N1rf, N1wrf **669**
D2 N1wdrf, N1wrf, N1rf, N1wdrf, N1wrf, N1wf, N1wf, N1wdf, N1wdf, N1wf-c **622**
D3 N1wncf, N1wdnrf, N1wn **346**
E S3wn, N1nf, N1wdnrf, S3wn **546**

MAIS DORI MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1wnr, N1w, S3wn, N1w, N1w, N1w **698**
B1 S3wr, N1wf, N1wd, N1w, N1wdf **299**
B2 N1w, N1wn, S3wn, N1wn, N1wn, S3wn, S3wn, N1wdn, N1wdn, S3wn, N1wdn, N1wn **729**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **795**

C22 S3wnc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1wnc, N1w, S3wn, N1wnr, S3wn, N1wn, N1wn, N1wn, N1wn, N1wn, S3wn, N1wdf, N1wdnf **851**
C31 N1wref, N1wdecf, N1wre, S3wne, N1we, N1we, N1wdrecf, N1wde **757**
C32 N1wr, N1wn, N1wf, S3w, N1wdcf, N1wdc, N1wc, N1w, N1wc, S3w, S3w, S3w, S3w, N1w, N1wr, N1wdrf, N1w, N1w, N1wr, N1w, N1wr, S3w, N1wf, N1wnrf, S3w, S3w, N1w, S3w, N1w, S3wn, N1wn, N1wn, S3w, N1w, S3w, S3w **863**
C41 N1we, N1wef, S3we, N1wre **763**
C42 N1wr, N1w, N1w, S3w, S3w, N1w, S3w, S3w, S3w, N1wd, N1w, S3w, S3w, N1wdf, N1w, N1wdf, N1w, N1w-c, N1wf, S3w, S3w, S3w, N1w, N1wdf, S3w **878**
C51 X **0**
C52 N1w, N1wf, N1w, N1w, N1w, N1w, S3w, S3w, S3w **805**
D1 N1wn, S3wn, N1wdnrf, N1wdcf, N1wdcf, N1wdcf, N1wf, N1wdf, N1wrf, N1wrf **975**
D2 N1wdrf, N1wrf, N1wrf, N1wdrf, N1wrf, N1wf, N1wf, N1wdf, N1wdf, N1wf-c **929**
D3 N1wncf, N1wdnrf, S3wn **772**
E S3wn, N1wnf, N1wdnrf, S3wn **785**

MAIS DORI WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1nr, N1nr, N1w, S3n, N1w, N1w, N1w **985**
B1 S3r, N1wf, N1wd, N1w, N1df **327**
B2 N1w, S3n, S3wn, N1wn, N1wn, S3n, N1wn, N1wdn, N1wdn, S3wn, N1wdn, S3n **645**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1wdnecf, N1wnef, N1dnef, N1dne **1308**
C22 N1wnc, N1wnr, S3n, S3n, S3wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **1550**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2186**
C32 S3r, N1wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **1953**
C41 N1we, N1ef, N1we, N1wre **556**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, N1w, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **1380**
C51 X **0**
C52 S2, N1f, N1w, S2, S2, N1w, S2, S2, S2 **1335**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2509**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2498**
D3 N1ncf, N1dnrf, S3n **1570**
E S3n, N1nf, N1dnrf, S3n **1982**

MAIS OUAGA DRY
MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, S3w, N1wnr, N1nr, N1w, S3n, N1w, S3w, S3w **771**
B1 S3r, N1wf, N1wd, N1w, N1df **210**
B2 N1w, S3wn, N1wn, N1wn, N1wn, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **652**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1wdnef, N1dne **1107**
C22 N1wnc, N1wnr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **1258**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1wdrecf, N1de **1531**
C32 S3r, N1wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **1445**
C41 N1we, N1ef, N1we, N1wre **539**
C42 N1r, S2, S3w, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, S2, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **1263**
C51 X **0**
C52 S3w, N1f, N1w, S2, S2, N1w, S2, S2, S2 **1157**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **1980**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2030**
D3 N1ncf, N1dnrf, S3n **1398**
E S3n, N1nf, N1dnrf, S3n **1801**

MAIS OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1nr, N1nr, S3w, S3n, S2, S1, S2 **1981**
B1 S3r, N1wf, N1wd, N1w, N1df **354**
B2 N1w, S3n, S3n, N1wn, S3wn, S3wn, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **1092**
C21 S3wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1wdnef, N1dne **1769**
C22 S3wnc, N1nr, S3n, S3wn, S3n, N1wn, N1nc, S3, S3wn, N1nr, S3wn, N1n, N1n, N1n, N1n, S3wn, S3wn, N1wdf, N1dnf **2008**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2601**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1wf, N1wnrf, S3, S2, S2, S2, S3w, S3wn, N1wn, S3n, S3w, N1w, S3w, S2 **2453**
C41 N1e, N1ef, S3we, S3wre **1367**
C42 N1r, S2, S2, S3w, S2, N1w, S2, S2, S3w, N1wd, N1w, N1w, S3w, N1df, S2, N1wdf, S2, N1-c, N1wf, S3w, S3w, S2, S1, N1df, S2 **1931**
C51 X **0**
C52 N1w, N1f, S3w, S2, S2, S2, S2, S2, S2 **2190**

D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2897**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2704**
D3 N1ncf, N1dnrf, S3n **2057**
E S3n, N1nf, N1dnrf, S3n **2326**

MAIS OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1nr, N1nr, N1w, S3n, S3w, S2, S3w **1778**
B1 S3r, N1wf, N1wd, N1w, N1df **540**
B2 N1w, S3n, S3n, N1wn, N1wn, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **1235**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1dnecf, N1wnef, N1wdnef, N1dne **1911**
C22 N1wnc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **2026**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1wdrecf, N1de **2490**
C32 S3r, S3wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2486**
C41 N1we, N1ef, N1we, N1wre **992**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, S2, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **1835**
C51 X **0**
C52 S3w, N1f, N1w, S2, S2, S3w, S2, S2, S2 **2151**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2607**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2831**
D3 N1ncf, N1dnrf, S3n **1444**
E S3n, N1nf, N1dnrf, S3n **1979**

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RIZ DORI DRY
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, N1wd, N1nr, N1nr, N1w, S3d, S3d, N1wd, S3d **659**
B1 S3dr, N1w, N1wd, N1wd, S1 **279**
B2 N1wd, S3dn, S2, N1w, N1wdn, S3dn, S3d, N1wd, N1wn, N1dn, N1wn, S3wn **616**
C21 N1wne, N1nre, N1ne, N1wdne, N1ne, N1dne, N1dnre, N1nre, N1dne, N1wnec, N1wdne, N1ne, N1wne **900**
C22 S3wnc, N1dnr, N1dn, S3dn, N1dn, N1wdn, N1dnc, S3, N1wdn, N1nr, N1wdn, N1n, N1n, N1dn, S3n, N1wdn, N1wdn, S3, S3n **963**
C31 N1dre, N1dec, N1re, S3dne, S3e, S3de, N1drec, S3e **1321**
C32 S3r, S3n, N1, S2, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S2, S3, N1r, N1dr, S2, S3d, N1r, N1, S3r, S3d, S3d, N1wnr, S3d, N1d, S3d, S2, N1w, S3wn, N1wn, S3n, S3w, N1w, S3d, S2 **1305**
C41 N1e, S3e, S3de, N1wre **655**
C42 N1r, S3d, S3d, S3d, S3d, N1w, S2, S3d, S3wd, N1w, N1wd, N1w, S2, S2, S3w, S2, S3d, N1-c, S3d, S3d, S3d, S3d, S2, S2, S3 **1182**
C51 X **0**
C52 S3w, S2, N1wd, S3, S3d, S3, S3d, S2, S2 **1132**
D1 N1wn, S3dn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1r **1545**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **1419**
D3 S3nc, N1nr, S3dn **988**
E S3dn, S3n, N1nr, S3n **1277**

RIZ DORI MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, N1wd, N1nr, N1wnr, S3w, S3d, N1wd, N1wd, N1wd **1100**
B1 N1wdr, N1w, N1wd, N1wd, S1 **515**
B2 N1wd, S3wdn, N1w, N1w, N1wdn, S3dn, N1wd, N1wd, N1wn, N1wdn, N1wn, N1wn **674**
C21 N1wne, N1nre, N1wne, N1wdne, N1ne, N1wdne, N1dnre, N1wnre, N1wdne, N1wnec, N1wdne, N1wne, N1wne **1193**
C22 N1wnc, N1wdnr, N1wdn, S3wdn, N1wdn, N1wdn, N1dnc, S3, N1wdn, N1nr, N1wdn, N1n, N1n, N1wdn, S3n, N1wdn, N1wdn, S3, S3n **1571**
C31 N1dre, N1wdec, N1re, S3wdne, S3e, S3wde, N1drec, S3e **2367**
C32 S3r, N1wn, N1, S3w, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S3w, S3, N1r, N1wdr, S2, S3d, N1r, N1, S3r, S3wd, S3wd, N1wnr, S3wd, N1d, S3d, S3w, N1w, N1wn, N1wn, S3n, N1w, N1w, N1wd, S2 **2283**
C41 N1we, S3we, N1wde, N1wre **567**
C42 N1r, S3d, N1wd, S3d, S3wd, N1w, S2, S3d, N1wd, N1w, N1wd, N1w, S3w, S2, N1w, S3w, S3d, N1-c, N1wd, N1wd, N1wd, S3d, N1w, S2, S2 **1520**
C51 X **0**
C52 S3, S3w, N1wd, S3, N1wd, N1w, S3d, S2, S2 **1617**
D1 N1wn, S3wdn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1wr **2454**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **2977**
D3 S3wnc, N1nr, S3wdn **1035**
E S3wdn, S3n, N1nr, S3wn **1832**

RIZ DORI WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S3d, N1nr, N1nr, S3w, S3d, S3d, S3d, S3d **2843**
B1 S3dr, N1w, N1wd, N1wd, S1 **846**
B2 N1wd, S3dn, S2, N1w, S3wdn, S3dn, S3d, N1wd, N1wn, N1dn, N1wn, S3n **1821**

C21 S3ne, N1nre, N1wne, N1wdne, N1ne, N1wdne, N1dnre, N1nre, N1dne, N1nec, N1dne, N1ne, N1ne **3166**
C22 S3wnc, N1dnr, N1dn, S3dn, N1dn, N1wdn, N1dnc, S3, S3wdn, N1nr, N1wdn, N1n, N1n, N1dn, S3n, S3dn, N1wdn, S3, S3n **3098**
C31 N1dre, N1dec, N1re, S3dne, S3e, S3de, N1drec, S3e **3615**
C32 S3r, S3n, N1, S2, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S2, S3, N1r, N1dr, S2, S3d, N1r, N1, S3r, S3d, S3d, N1nr, S3d, N1d, S3d, S2, S3w, S3wn, N1wn, S3n, S3w, N1w, S3wd, S2 **3464**
C41 N1we, S3e, S3wde, S3wre **1468**
C42 N1r, S3d, S3d, S3d, S3d, N1w, S2, S3d, S3wd, N1w, N1wd, N1w, S2, S2, S2, S2, S3d, N1-c, S3wd, S3wd, S3wd, S3d, S2, S2, S2 **2919**
C51 X **0**
C52 S3, S2, N1wd, S3, S3d, S3w, S3d, S2, S2 **3206**
D1 N1n, S3dn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1r **3601**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **3860**
D3 S3nc, N1nr, S3dn **2100**
E S3dn, S3n, N1nr, S3n **2870**

RIZ OUAGA DRY
MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, S3d, N1wnr, N1nr, N1w, S3d, S3wd, S3d, N1wd **1194**
B1 S3dr, N1w, N1wd, N1wd, S1 **525**
B2 N1wd, S3dn, S3w, N1w, N1wdn, S3wdn, S3d, N1wd, N1wn, N1wdn, N1wn, S3n **785**
C21 N1wne, N1nre, N1wne, N1wdne, N1ne, N1wdne, N1dnre, N1nre, N1dne, N1nec, N1wdne, N1ne, N1ne **1453**
C22 N1wnc, N1dnr, N1dn, S3wdn, N1wdn, N1wdn, N1dnc, S3, N1wdn, N1nr, N1wdn, N1n, N1n, N1dn, S3n, N1wdn, N1wdn, S3w, S3n **1245**
C31 N1dre, N1dec, N1re, S3dne, S3e, S3de, N1drec, S3e **1874**
C32 S3r, S3wn, N1, S2, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S3, S3, N1r, N1dr, S2, S3d, N1r, N1, S3r, S3d, S3wd, N1wnr, S3d, N1d, S3d, S3, N1w, N1wn, N1wn, S3n, N1w, N1w, N1wd, S2 **1441**
C41 N1we, S3e, N1wde, N1wre **606**
C42 N1r, S3d, S3wd, S3d, N1wd, N1w, S2, S3d, N1wd, N1w, N1wd, N1w, N1w, S2, S3w, S2, S3d, N1-c, N1wd, N1wd, N1wd, S3d, N1w, S3w, S2 **1084**
C51 X **0**
C52 S3w, S2, N1wd, S3, S3d, S3w, S3d, S3, S2 **1353**
D1 N1n, S3dn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1r **1769**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **1974**
D3 S3nc, N1nr, N1wdn **588**
E S3dn, S3n, N1nr, S3n **1020**

RIZ OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S3wd, N1nr, N1nr, N1w, S3d, S3wd, S3wd, S3d **1650**
B1 S3dr, N1w, N1wd, N1wd, S1 **712**
B2 N1wd, S3dn, S3w, N1w, N1wdn, S3dn, S3d, N1wd, N1wn, N1dn, N1wn, S3n **1058**
C21 N1wne, N1nre, N1wne, N1wdne, N1ne, N1wdne, N1dnre, N1nre, N1dne, N1wnec, N1wdne, N1ne, N1ne **1841**
C22 N1wnc, N1wdnr, N1dn, S3dn, N1wdn, N1wdn, N1dnc, S3, N1wdn, N1nr, N1wdn, N1n, N1n, N1dn, S3n, N1wdn, N1wdn, S3, S3n **1957**
C31 N1dre, N1dec, N1re, S3dne, S3e, S3de, N1drec, S3e **2578**
C32 S3r, S3wn, N1, S2, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S2, S3, N1r, N1dr, S2, S3d, N1r, N1, S3r, S3d, S3d, N1wnr, S3d, N1d, S3d, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1wd, S2 **2051**
C41 N1we, S3e, N1wde, N1wre **747**
C42 N1r, S3d, S3d, S3d, S3d, N1w, S2, S3d, N1wd, N1w, N1wd, N1w, S2, S2, S2, S2, S3d, N1-c, N1wd, N1wd, N1wd, S3d, S2, S2, S3 **1729**
C51 X **0**
C52 S3, S2, N1wd, S3, S3d, N1w, S3d, S2, S2 **1784**
D1 N1wn, S3dn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1r **2420**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **2513**
D3 S3nc, N1nr, S3dn **1345**
E S3dn, S3n, N1nr, S3n **1603**

RIZ OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S3wd, N1nr, N1nr, N1w, S3d, N1wd, S3wd, N1wd **1572**
B1 S3dr, N1w, N1wd, N1wd, S1 **705**
B2 N1wd, S3wdn, S3w, N1w, N1wdn, S3dn, S3d, N1wd, N1wn, N1wdn, N1wn, S3n **1057**
C21 N1wne, N1nre, N1ne, N1wdne, N1ne, N1dne, N1dnre, N1nre, N1dne, N1wnec, N1wdne, N1ne, N1ne **2110**
C22 S3wnc, N1wdnr, N1dn, S3dn, N1wdn, N1wdn, N1dnc, S3, N1wdn, N1nr, N1wdn, N1n, N1n, N1dn, S3n, N1wdn, N1wdn, S3, S3n **2103**
C31 N1dre, N1dec, N1re, S3dne, S3e, S3de, N1drec, S3e **2913**
C32 S3r, N1wn, N1, S2, N1c, S3c, N1dc, S3, N1c, S3d, S2, S3d, S2, S3, N1r, N1dr, S2, S3d, N1r, N1, S3r, S3d, S3d, N1wnr, S3d, N1d, S3d, S3, N1w, N1wn, N1wn, S3n, N1w, N1w, S3d, S2 **2834**
C41 N1we, S3e, S3de, S3wre **1284**
C42 N1r, S3d, S3d, S3d, S3d, N1w, S2, S3d, S3wd, N1w, N1wd, N1w, S3, S2, N1w, S2, S3d, N1-c, S3d, S3d, S3d, S3d, S2, S2, S2 **2235**
C51 X **0**

C52 S3w, S2, N1wd, S3, S3d, N1w, S3d, S2, S2 **2208**
D1 N1wn, S3dn, N1nr, S3c, S3c, N1c, S2, S2, N1r, N1r **2895**
D2 N1r, N1r, S3r, N1r, N1r, S2, S3, S2, S2, S2-c **3375**
D3 S3nc, N1nr, S3dn **1508**
E S3dn, S3n, N1nr, S3n **2129**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1wnr, N1wnr, N1w, S3n, N1w, S2, N1w **788**
B1 N1wr, N1wf, N1wd, N1w, N1df **317**
B2 N1w, S3wn, S3wn, N1wn, N1wn, S3n, S3n, N1wdn, N1wdn, S3wn, N1wdn, N1wn **571**
C21 N1wne, N1wnre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1wnre, N1ne, N1wdnecf, N1wnef, N1wdnef, N1wdne **735**
C22 N1wnc, N1nr, S3n, S3n, S3wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1wn, N1n, N1wn, N1n, N1wn, N1wn, N1df, N1dnf **992**
C31 N1ref, N1wdecf, N1re, S3ne, S3e, S3we, N1wdrecf, N1de **1523**
C32 S3r, N1wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, N1w, S2, S3, N1r, N1wdrf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S3w **1412**
C41 N1we, N1ef, N1we, N1wre **424**
C42 N1r, S2, N1w, S3, S2, N1w, S3w, S3w, N1w, N1wd, N1w, S3w, S2, N1df, N1w, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S3w, N1wdf, S3w **859**
C51 X **0**
C52 S3w, N1f, N1w, S2, S3w, N1w, S2, S2, N1w **943**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1wdf, N1rf, N1rf **1738**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **1930**
D3 N1ncf, N1wdnrf, S3wn **810**
E S3n, N1nf, N1wdnrf, S3n **1109**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, N1w, N1wnr, N1wnr, S3w, S3wn, N1w, S3w, N1w **970**
B1 N1wr, N1wf, N1wd, S3w, N1wdf **460**
B2 N1w, S3wn, S3wn, S3wn, S3wn, S3n, S3wn, N1wdn, N1wdn, S3wn, N1wdn, S3wn **966**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1ne, N1wdnecf, N1wnef, N1wdnef, N1wdne **1101**
C22 S3wnc, N1wnr, S3n, S3n, S3wn, N1wn, N1wnc, N1w, S3wn, N1wnr, S3wn, N1wn, N1wn, N1wn, N1wn, S3wn, S3wn, N1df, N1dnf **1224**
C31 N1wref, N1wdecf, N1wre, S3ne, S3we, N1we, N1wdrecf, N1wde **1092**
C32 S3wr, N1wn, N1wf, S2, N1wdcf, N1wdc, S3wc, S3w, N1c, S2, S3w, S3w, S2, S3w, N1wr, N1wdrf, S3w, S3w, N1wr, N1w, N1wr, S3, N1f, N1wnrf, S3, S2, S3w, S2, S3w, S3wn, N1wn, S3wn, S3w, S3w, S2, S3w **1287**
C41 N1we, N1ef, S3e, S3wre **1204**
C42 N1wr, S3w, S3w, S3, S3w, N1w, N1w, S2, S3w, N1wd, S3w, S3w, S3w, N1df, N1w, N1df, S3w, N1w-c, N1f, S2, S2, S2, S3w, N1wdf, S3w **1313**
C51 X **0**
C52 S3w, N1wf, S3w, S3w, S3w, N1w, S2, S2, S3w **1228**
D1 N1wn, S3n, N1dnrf, N1dcf, N1wdcf, N1dcf, N1wf, N1wdf, N1wrf, N1wrf **1439**
D2 N1drf, N1wrf, N1wrf, N1drf, N1wrf, N1f, N1wf, N1df, N1df, N1wf-c **1383**
D3 N1ncf, N1dnrf, S3wn **1098**
E S3n, N1wnf, N1dnrf, S3n **1142**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, S1, N1nr, N1nr, N1w, S3n, S2, S1, S3w **1746**
B1 S3r, N1wf, N1wd, N1w, N1df **500**
B2 N1w, S3n, N1wn, N1wn, S3wn, S3n, S3n, N1wdn, N1wdn, S3wn, N1wdn, S3n **1078**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1wdnecf, N1wnef, N1dnef, N1dne **1411**
C22 N1wnc, N1nr, S3n, S3n, S3wn, N1wn, N1nc, S3w, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **1920**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2941**
C32 S3r, S3n, N1f, S2, N1dcf, N1wdc, S3c, S2, N1c, S2, S2, N1w, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2844**
C41 N1e, N1ef, N1we, S3wre **1474**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, N1w, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **1899**
C51 X **0**
C52 S2, N1f, N1w, S2, S2, N1w, S2, S2, S2 **2108**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **3351**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **3766**
D3 N1ncf, N1dnrf, S3n **2085**
E S3n, N1nf, N1dnrf, S3n **2694**

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MAPCODE$ CLASS$ YLD2AGGR

AC1 S2, S2, N1nr, N1nr, S3w, S3n, S2, S2, S2 **2131**
B1 S3r, N1wf, N1wd, S3w, N1df **741**
B2 N1w, S3n, S3n, S3wn, N1wn, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **1464**
C21 S3ne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1dnef, N1dne **1947**
C22 N1wnc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, S3n, N1wn, N1df, N1dnf **2206**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2619**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2842**
C41 N1e, N1ef, N1we, S3re **1425**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S3w, N1df, S2, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **2172**
C51 X **0**
C52 S2, N1f, S3w, S2, S2, S2, S2, S2, S2 **2488**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **3037**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **3199**
D3 N1ncf, N1dnrf, S3n **1772**
E S3n, N1nf, N1dnrf, S3n **2354**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, S2, S3n, S2, S1, S3w **2904**
B1 S3r, N1wf, N1wd, S2, N1df **928**
B2 N1w, S3n, S3n, S3wn, S3n, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **2034**
C21 S3ne, N1nre, N1ne, N1wne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1dnef, N1dne **3084**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3n, N1n, N1n, N1n, N1n, S3n, S3n, N1df, N1dnf **3113**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **3621**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1nrf, S3, S2, S2, S2, S2, S3n, N1wn, S3n, S2, S3w, S2, S2 **3723**
C41 N1e, N1ef, S3e, S3re **2737**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1wd, N1w, S2, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S1, N1df, S2 **3345**
C51 X **0**
C52 S2, N1f, S2, S2, S2, S2, S2, S2, S2 **3274**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **3766**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **3862**
D3 N1ncf, N1dnrf, S3n **2829**
E S3n, N1nf, N1dnrf, S3n **3138**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, N1w, N1nr, N1nr, S3w, S3n, S2, S2, S3w **1896**
B1 S3r, N1wf, N1wd, N1w, N1df **829**
B2 N1w, S3n, S3n, N1wn, S3n, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **1785**
C21 N1wne, N1nre, N1ne, N1wne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1wnef, N1dnef, N1dne **2699**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, S3wn, N1wn, N1df, N1dnf **2719**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **3570**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, S2, S3wn, N1wn, S3n, S2, N1w, S2, S2 **3527**
C41 N1we, N1ef, S3e, S3re **2004**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1wd, N1w, N1w, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S2, N1df, S2 **2836**
C51 X **0**
C52 S2, N1f, S3w, S2, S2, S3w, S2, S2, S2 **2944**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **3494**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **3517**
D3 N1ncf, N1dnrf, S3n **1715**
E S3n, N1nf, N1dnrf, S3n **2789**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S2, N1nr, N1nr, N1w, S2, N1w, N1w, N1w **410**
B1 S3r, N1wf, N1wd, N1w, N1df **150**
B2 N1w, S3n, N1w, N1w, N1wn, N1wn, N1w, N1wd, N1wdn, S3wn, N1wdn, S3n **205**
C21 N1wne, N1wnre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1wdnecf, N1wnef, N1wdnef, N1dne **381**
C22 N1wnc, N1wnr, S3n, N1wn, S3wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1wn, N1n, N1wn, N1wn, N1wn, N1wn, N1wdf, N1dnf **349**
C31 N1ref, N1decf, N1re, S3ne, S3we, N1we, N1wdrecf, N1de **629**

C32 S3r, N1wn, N1wf, S2, N1wdcf, N1dc, S3c, N1w, N1c, S2, S2, S2, S2, S3, N1r, N1drf, N1w, S2, N1wr, N1, S3wr, S3, N1wf, N1wnrf, S3, S2, N1w, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **540**
C41 N1we, N1ef, N1we, N1wre **252**
C42 N1r, S2, N1w, N1w, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, N1w, N1df, N1w, N1wdf, N1w, N1-c, N1wf, N1w, N1w, S2, N1w, N1wdf, S2 **316**
C51 X **0**
C52 N1w, N1f, N1w, S2, S2, N1w, S2, S2, S3w **591**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1wf, N1wdf, N1wrf, N1rf **528**
D2 N1wdrf, N1wrf, N1wrf, N1drf, N1wrf, N1f, N1f, N1wdf, N1df, N1f-c **486**
D3 N1ncf, N1wdnrf, S3n **464**
E S3n, N1wnf, N1wdnrf, S3n **351**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, S3w, N1wnr, N1wnr, N1w, S3w, N1w, S3w, N1w **484**
B1 S3wr, N1wf, N1wd, N1w, N1wdf **112**
B2 N1w, S3wn, S3w, N1w, N1wn, S3wn, S3w, N1wd, N1wdn, S3wn, N1wdn, S3wn **388**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **494**
C22 N1wnc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1wnc, S3w, N1wn, N1wnr, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wdf, N1wdnf **526**
C31 N1wref, N1wdecf, N1wre, S3wne, S3we, S3we, N1wdrecf, N1wde **574**
C32 S3wr, N1wn, N1wf, S3w, N1wdcf, N1wdc, S3wc, S3w, N1wc, S3w, S3w, N1w, S3w, S3w, N1wr, N1wdrf, S3w, S3w, N1wr, N1w, S3wr, S3w, N1wf, N1wnrf, S3w, S3w, S3w, S3w, N1w, N1wn, N1wn, S3wn, N1w, N1w, N1w, N1w **570**
C41 N1we, N1wef, N1we, N1wre **358**
C42 N1wr, S3w, S3w, S3w, S3w, N1w, N1w, S3w, N1w, N1wd, N1w, N1w, S3w, N1wdf, S3w, N1wdf, S3w, N1w-c, N1wf, N1w, N1w, S3w, S3w, N1wdf, N1w **507**
C51 X **0**
C52 S3w, N1wf, N1w, S3w, S3w, N1w, S3w, S3w, S3w **578**
D1 N1wn, S3wn, N1wdnrf, N1wdcf, N1wdcf, N1wdcf, N1wf, N1wdf, N1wrf, N1wrf **681**
D2 N1wdrf, N1wrf, N1wrf, N1wdrf, N1wrf, N1wf, N1wf, N1wdf, N1wdf, N1wf-c **656**
D3 N1wncf, N1wdnrf, S3wn **536**
E S3wn, N1wnf, N1wdnrf, S3wn **561**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 S3w, N1w, N1wnr, N1wnr, N1w, S3w, N1w, N1w, N1w **295**
B1 S3wr, N1wf, N1wd, N1w, N1wdf **127**
B2 N1w, N1wn, N1w, N1w, N1wn, N1wn, N1w, N1wd, N1wdn, N1wn, N1wdn, S3wn **97**
C21 N1wne, N1nre, N1wne, N1wne, N1wdnef, N1wne, N1nre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **352**
C22 N1wnc, N1wnr, N1wn, N1wn, N1wn, N1wn, N1wnc, N1w, N1wn, N1nr, N1wn, N1n, N1wn, N1wn, N1wn, N1wn, N1wn, N1wdf, N1dnf **305**
C31 N1wref, N1wdecf, N1wre, N1wne, N1we, S3we, N1wdrecf, N1wde **359**
C32 S3r, N1wn, N1f, S3w, N1dcf, N1wdc, N1wc, S2, N1c, N1w, N1w, N1w, N1w, N1w, N1wr, N1wdrf, N1w, N1w, N1wr, N1, N1wr, N1w, N1wf, N1wnrf, N1w, N1w, S3w, S3w, N1w, N1wn, N1wn, N1wn, N1w, N1w, N1w, N1w **483**
C41 N1we, N1wef, N1we, N1wre **155**
C42 N1wr, S3w, S3w, N1w, N1w, N1w, S3w, S2, N1w, N1wd, N1w, N1w, N1w, N1wdf, N1w, N1wdf, S3w, N1w-c, N1wf, N1w, N1w, N1w, N1w, N1wdf, N1w **369**
C51 X **0**
C52 N1w, N1wf, N1w, S3w, S2, N1w, N1w, N1w, S2 **566**
D1 N1wn, N1wn, N1dnrf, N1dcf, N1wdcf, N1dcf, N1wf, N1wdf, N1wrf, N1wrf **788**
D2 N1drf, N1wrf, N1wrf, N1drf, N1rf, N1wf, N1f, N1df, N1df, N1wf-c **1037**
D3 N1wncf, N1dnrf, N1wn **415**
E N1wn, N1wnf, N1dnrf, S3wn **752**

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MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1nr, N1w, S2, N1w, N1w, N1w **420**
B1 S3r, N1wf, N1wd, N1w, N1wdf **109**
B2 N1w, S3n, N1w, N1w, N1wn, S3wn, N1w, N1wd, N1wdn, S3wn, N1wdn, S3wn **363**
C21 N1wne, N1wnre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1wnre, N1ne, N1dnecf, N1nef, N1wdnef, N1wdne **799**
C22 N1wnc, N1wnr, S3n, S3wn, S3n, N1wn, N1wnc, N1w, N1wn, N1nr, N1wn, N1wn, N1n, N1wn, N1n, N1wn, N1wn, N1wdf, N1dnf **666**
C31 N1ref, N1decf, N1re, S3ne, N1we, S3e, N1wdrecf, N1de **1029**
C32 S3r, N1wn, N1wf, S2, N1wdcf, N1dc, S3c, N1w, N1c, S2, S2, S2, S2, S3w, N1r, N1drf, N1w, S2, N1wr, N1, N1wr, S3, N1wf, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3wn, N1w, N1w, N1w, S2 **895**
C41 N1we, N1ef, N1we, N1wre **531**
C42 N1wr, S3w, S2, S3w, S3w, N1w, S2, S2, N1w, N1wd, N1w, N1w, S3w, N1df, S2, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **902**
C51 X **0**
C52 S3w, N1f, N1w, S3w, S2, N1w, S2, S2, S2 **1004**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1wf, N1wdf, N1rf, N1rf **1374**
D2 N1drf, N1wrf, N1wrf, N1drf, N1wrf, N1f, N1f, N1df, N1df, N1wf-c **1079**

D3 N1ncf, N1dnrf, S3n **1164**
E S3n, N1nf, N1dnrf, S3n **1285**

ARACHIDE OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, S2, N1wnr, N1wnr, N1w, S3w, N1w, S3w, S3w **512**
B1 S3wr, N1wf, N1wd, N1w, N1df **458**
B2 N1w, N1wn, S3w, N1w, N1wn, S3wn, S3w, N1wd, N1wdn, S3wn, N1wdn, S3n **516**
C21 N1wne, N1nre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1dnecf, N1wnef, N1dnef, N1dne **903**
C22 N1wnc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1wnc, S3w, N1wn, N1wnr, N1wn, N1n, N1n, N1wn, N1n, N1wn, N1wn, N1wdf, N1dnf **919**
C31 N1wref, N1decf, N1wre, S3wne, S3we, S3e, N1drecf, N1wde **1192**
C32 S3wr, N1wn, N1f, S3w, N1dcf, N1wdc, S3wc, S2, N1c, S3w, S2, S2, S3w, S3w, N1wr, N1wdrf, S2, S3w, N1r, N1w, S3wr, S3w, N1wf, N1wnrf, S3w, S2, S2, S3w, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **1138**
C41 N1we, N1wef, N1we, N1wre **392**
C42 N1r, S2, N1w, S3w, S3w, N1w, S3w, S2, N1w, N1wd, N1w, N1w, S3w, N1df, S2, N1wdf, S2, N1w-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **991**
C51 X **0**
C52 S3w, N1f, N1w, S2, S3w, N1w, S2, S2, S2 **1311**
D1 N1n, S3wn, N1dnrf, N1dcf, N1wdcf, N1dcf, N1wf, N1df, N1rf, N1wrf **1580**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1wf, N1df, N1df, N1f-c **2027**
D3 N1wncf, N1dnrf, S3wn **1079**
E S3wn, N1nf, N1dnrf, S3wn **1409**

ARACHIDE OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1wnr, N1w, S3w, N1w, N1w, N1w **444**
B1 S3wr, N1wf, N1wd, N1w, N1wdf **149**
B2 N1w, S3wn, N1w, N1w, N1wn, S3wn, N1w, N1wd, N1wdn, S3wn, N1wdn, S3wn **390**
C21 N1wne, N1nre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1nre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **638**
C22 N1wnc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1wn, N1wn, N1n, N1wn, N1wn, N1wn, N1wdf, N1dnf **764**
C31 N1wref, N1wdecf, N1re, S3wne, S3e, S3e, N1wdrecf, N1de **952**
C32 S3wr, N1wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S3w, S3w, S3w, S2, S3, N1r, N1drf, S2, S2, N1r, N1w, S3r, S3, N1wf, N1wnrf, S3w, S3w, S2, S2, N1w, N1wn, N1wn, S3wn, N1w, N1w, N1w, S3w **926**
C41 N1we, N1ef, N1we, N1wre **401**
C42 N1wr, S3w, S3w, S3w, S3w, N1w, S3w, S2, N1w, N1wd, N1w, N1w, S3w, N1wdf, S3w, N1wdf, S2, N1w-c, N1wf, N1w, N1w, S3w, S3w, N1df, S3w **693**
C51 X **0**
C52 N1w, N1wf, N1w, S3w, S2, N1w, S3w, S3w, S2 **817**
D1 N1wn, S3wn, N1dnrf, N1dcf, N1wdcf, N1dcf, N1f, N1df, N1rf, N1rf **1319**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1wf, N1wf, N1df, N1df, N1wf-c **1225**
D3 N1wncf, N1dnrf, S3wn **875**
E S3wn, N1nf, N1dnrf, S3n **983**

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NIEBE DORI DRY
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1wnr, N1w, N1wn, N1w, N1w, N1w **0**
B1 N1wr, N1wf, N1wd, N1w, N1wdf **0**
B2 N1w, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wdn, N1wdn, N1wn, N1wdn, N1wn **0**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **0**
C22 N1wnc, N1wnr, N1wn, N1wn, N1wn, N1wn, N1wnc, N1w, N1wn, N1wnr, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wn, N1wdf, N1wdnf **8**
C31 N1wref, N1wdecf, N1wre, N1wne, N1we, N1we, N1wdrecf, N1wde **0**
C32 N1wr, N1wn, N1wf, N1w, N1wdcf, N1wdc, N1wc, N1w, N1wc, N1w, N1w, N1w, N1w, N1w, N1wr, N1wdrf, N1w, N1w, N1wr, N1w, N1wr, N1w, N1wf, N1wnrf, N1w, N1w, N1w, N1w, N1w, N1wn, N1wn, N1wn, N1w, N1w, N1w, N1w **4**
C41 N1we, N1wef, N1we, N1wre **0**
C42 N1wr, N1w, N1w, N1w, N1w, N1w, N1w, N1w, N1w, N1wd, N1w, N1w, N1w, N1wdf, N1w, N1wdf, N1w, N1w-c, N1wf, N1w, N1w, N1w, N1w, N1wdf, N1w **38**
C51 X **0**
C52 N1w, N1wf, N1w, N1w, N1w, N1w, N1w, N1w, N1w **4**
D1 N1wn, N1wn, N1wdnrf, N1wdcf, N1wdcf, N1wdcf, N1wf, N1wdf, N1wrf, N1wrf **42**
D2 N1wdrf, N1wrf, N1wrf, N1wdrf, N1wrf, N1wf, N1wf, N1wdf, N1wdf, N1wf-c **40**
D3 N1wncf, N1wdnrf, N1wn **17**
E N1wn, N1wnf, N1wdnrf, N1wn **13**

NIEBE DORI MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, N1w, N1wnr, N1wnr, N1w, N1wn, N1w, N1w, N1w **347**
B1 N1wr, N1wf, S3wd, N1w, N1wdf **352**

B2 N1w, N1wn, N1wn, N1wn, S3wn, S3wn, S3wn, N1wdn, N1wdn, S3wn, N1wdn, N1wn **659**
C21 N1wne, N1wnre, N1wne, N1wne, N1wdnef, N1wne, N1wnre, N1wnre, N1wne, N1wdnecf, N1wnef, N1wdnef, N1wdne **528**
C22 S3wnc, N1wnr, S3wn, S3wn, S3wn, N1wn, N1wnc, S3w, S3wn, N1wnr, S3wn, N1wn, N1wn, N1wn, N1wn, N1wn, S3wn, N1wdf, N1wdnf **758**
C31 N1wref, N1wdecf, N1wre, S3wne, N1we, N1we, N1wdrecf, N1wde **414**
C32 N1wr, N1wn, N1wf, S3w, N1wdcf, N1wdc, N1wc, N1w, N1wc, S3w, N1w, N1w, S3w, S3w, N1wr, N1wdrf, N1w, S3w, N1wr, N1w, N1wr, S3w, N1wf, N1wnrf, S3w, N1w, N1w, S3w, S3w, S3wn, N1wn, N1wn, S3w, N1w, S3w, N1w **680**
C41 N1we, N1wef, S3we, S3wre **957**
C42 N1wr, N1w, N1w, S3w, S3w, N1w, N1w, N1w, S3w, N1wd, S3w, S3w, S3w, N1wdf, N1w, N1wdf, N1w, N1w-c, N1wf, S3w, S3w, N1w, N1w, N1wdf, N1w **725**
C51 X **0**
C52 N1w, N1wf, S3w, N1w, N1w, N1w, N1w, N1w, N1w **342**
D1 N1wn, S3wn, N1wdnrf, N1wdcf, N1wdcf, N1wdcf, N1wf, N1wdf, N1wrf, N1wrf **589**
D2 N1wdrf, N1wrf, N1wrf, N1wdrf, N1wrf, N1wf, N1wf, N1wdf, N1wdf, N1wf-c **422**
D3 N1wncf, N1wdnrf, S3wn **724**
E S3wn, N1wnf, N1wdnrf, S3wn **570**

NI**E**BE DORI WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, N1w, S3n, N1w, S1, N1w **1824**
B1 S3r, N1wf, N1wd, N1w, N1df **427**
B2 N1w, S3n, N1wn, N1wn, N1wn, S3n, S3n, N1wdn, N1wdn, N1wn, N1wdn, S3n **1077**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1wdnecf, N1wnef, N1dnef, N1dne **1840**
C22 N1wnc, N1nr, S3n, S3n, N1wn, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **2271**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **3127**
C32 S3r, N1wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2806**
C41 N1we, N1ef, N1we, N1wre **1168**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, N1w, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **2292**
C51 X **0**
C52 S2, N1f, N1w, S2, S2, N1w, S2, S2, S2 **2371**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **3613**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **3445**
D3 N1ncf, N1dnrf, S3n **2739**
E S3n, N1nf, N1dnrf, S3n **3074**

NI**E**BE OUAGA DRY
MAPCODE$ CLASS$ YLD2AGGR
AC1 S2, S1, N1nr, N1nr, N1w, S3n, S3w, S1, S2 1998
B1 S3r, N1wf, N1wd, N1w, N1df **345**
B2 N1w, S3n, S3n, N1wn, N1wn, S3n, S3n, N1wdn, N1wdn, S3n, N1wdn, S3n **1149**
C21 N1wne, N1nre, N1wne, N1wne, N1dnef, N1wne, N1nre, N1nre, N1ne, N1dnecf, N1nef, N1dnef, N1dne **1943**
C22 N1wnc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1n, N1n, N1n, N1n, N1wn, N1wn, N1df, N1dnf **2050**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2877**
C32 S3r, S3wn, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2516**
C41 N1we, N1ef, N1we, N1wre **960**
C42 N1r, S2, S2, S3, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, S2, N1df, S2, N1-c, N1wf, N1w, N1w, S2, S2, N1df, S2 **1858**
C51 X **0**
C52 S2, N1f, N1w, S2, S2, S3w, S2, S2, S2 **2283**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1wrf **2636**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2754**
D3 N1ncf, N1dnrf, S3n **2350**
E S3n, N1nf, N1dnrf, S3n **2060**

NI**E**BE OUAGA MEDIUM
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, S1, N1wnr, N1nr, S3w, S3n, S3w, S1, S2 **1822**
B1 S3r, N1wf, N1wd, S3w, N1df **712**
B2 N1w, S3n, N1wn, S3wn, S3n, S3n, N1wn, N1wdn, N1wdn, S3n, N1wdn, S3n **1529**
C21 S3wne, N1nre, N1ne, N1wne, N1dnef, N1ne, N1nre, N1nre, N1ne, N1dnecf, N1wnef, N1wdnef, N1dne **2045**
C22 S3nc, N1nr, S3n, S3n, S3n, N1wn, N1nc, S3, S3n, N1nr, S3wn, N1n, N1n, N1n, N1n, S3wn, S3n, N1df, N1dnf **2619**
C31 N1ref, N1decf, N1re, S3ne, S3e, S3e, N1drecf, N1de **2629**
C32 S3r, S3n, N1f, S2, N1dcf, N1dc, S3c, S2, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, S2, S3n, N1wn, S3n, S2, N1w, S2, S2 **2605**
C41 N1we, N1ef, S3e, S3re **2487**

C42 N1r, S2, S2, S3, S2, N1w, S2, S2, S2, N1wd, N1w, S3w, S2, N1df, S2, N1df, S2, N1-c, N1f, S2, S2, S2, S1, N1df, S2 **2633**
C51 X **0**
C52 S2, N1f, S2, S2, S2, S3w, S2, S2, S2 **2749**
D1 N1n, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1df, N1rf, N1rf **2980**
D2 N1drf, N1rf, N1rf, N1drf, N1rf, N1f, N1f, N1df, N1df, N1f-c **2756**
D3 N1ncf, N1dnrf, S3n **2721**
E S3n, N1nf, N1dnrf, S3n **2580**

NIEBE OUAGA WET
MAPCODE$ CLASS$ YLD2AGGR
AC1 N1w, S1, N1wnr, N1wnr, N1w, S3n, N1w, S3w, N1w **1067**
B1 N1wr, N1wf, N1wd, N1w, N1df **477**
B2 N1w, N1wn, N1wn, N1wn, N1wn, S3n, N1wn, N1wdn, N1wdn, S3n, N1wdn, S3n **711**
C21 N1wne, N1wnre, N1wne, N1wne, N1dnef, N1wne, N1wnre, N1nre, N1ne, N1wdnecf, N1wnef, N1dnef, N1dne **1287**
C22 N1wnc, N1wnr, S3n, S3n, S3n, N1wn, N1nc, S3, N1wn, N1nr, N1wn, N1wn, N1wn, N1n, N1wn, N1wn, N1wn, N1df, N1dnf **1706**
C31 N1wref, N1decf, N1re, S3ne, S3e, S3e, N1wdrecf, N1de **2575**
C32 S3r, N1wn, N1f, S2, N1wdcf, N1dc, S3c, S3w, N1c, S2, S2, S2, S2, S3, N1r, N1drf, S2, S2, N1r, N1, S3r, S3, N1f, N1wnrf, S3, S2, S2, S2, N1w, N1wn, N1wn, S3n, N1w, N1w, N1w, S2 **2399**
C41 N1we, N1ef, N1we, N1wre **983**
C42 N1r, S2, N1w, N1w, S2, N1w, S2, S2, N1w, N1wd, N1w, N1w, S2, N1df, N1w, N1wdf, S2, N1-c, N1wf, N1w, N1w, S2, N1w, N1df, S2 **1388**
C51 X **0**
C52 S2, N1wf, N1w, S2, S2, N1w, S2, S2, S2 **1907**
D1 N1wn, S3n, N1dnrf, N1dcf, N1dcf, N1dcf, N1f, N1wdf, N1rf, N1rf **2562**
D2 N1drf, N1rf, N1rf, N1drf, N1wrf, N1f, N1f, N1df, N1df, N1f-c **2668**
D3 N1ncf, N1dnrf, S3n **1729**
E S3n, N1nf, N1dnrf, S3n **2176**

Annex 6. Soil data (van Lieshout et.al., 1997) used for the land suitability assessment

Annex 6a. Terrain data

Plot nr	Longitud (utm)	Latitude (utm)	Legend map	Topo	Slope	Surfac course	Area erosion	Degre erosio	Thick seal	Const seal	Drain	Intern drain	Flood
709	675968	1431324	B2	1	2	6	5	2	2	2	4	3	0
710	675515	1438504	C42	1	2	2	5	2	2	1	3	4	0
711	674500	1438400	AC1	5	6	5	4	1	1	1	1	2	0
712	663570	1435855	B2	1	2	2	3	1	1	-99	3	4	0
713	663187	1432044	C42	3	2	5	4	1	2	1	3	4	0
714	670497	1442800	C42	2	2	5	5	2	2	1	4	4	0
715	670673	1445074	B1	1	2	6	-99	-99	1	-99	4	3	1
716	662586	1454021	B2	1	2	2	5	2	2	1	3	4	0
717	684178	1447771	B2	2	3	6	5	2	1	0	3	3	0
906	682462	1443470	C	2	2	3	5	2	2	1	3	4	0
718	681783	1442075	C21	2	2	3	6	3	3	2	4	3	0
719	680900	1435400	C31	2	2	2	6	3	5	3	1	1	1
123	716094	1482210	C32	1	1	1	-99	-99	2	3	4	2	0
122	714572	1482119	C21	1	1	1	-99	-99	3	1	3	3	0
4	714692	1482084	C22	1	2	3	2	2	3	1	3	3	0
121	714561	1482108	C21	1	2	3	2	2	2	3	4	2	0
6	689891	1486526	D	1	2	1	-99	1	2	1	4	3	0
7	699320	1519143	D	1	1	2	-99	-99	2	1	2	1	1
124	715625	1482256	C32	1	1	1	-99	-99	2	1	4	3	0
12	691320	1485524	B2	1	4	6	2	1	2	1	1	2	0
13	698354	1517182	C32	1	1	1	-99	-99	2	1	4	3	1
14	691504	1485292	C2	2	3	5	6	1	3	2	1	2	0
15	691508	1485116	C3	1	2	1	-99	-99	4	3	3	3	0
16	691461	1484936	C3	1	2	1	-99	-99	1	-99	3	4	0
17	691480	1484591	A	1	1	1	-99	-99	1	-99	4	3	1
21	713173	1481708	C21	1	1	2	6	1	3	2	5	1	1
23	713556	1482011	C21	1	2	2	5	2	3	1	2	5	0
24	713540	1481310	B1	2	3	4	6	1	3	1	3	3	0
26	713430	1480750	C32	1	2	1	-99	-99	2	1	4	3	0
31	716100	1489357	C32	1	1	1	-99	-99	5	3	5	2	1
32	716057	1489300	D2	1	1	1	-99	-99	5	3	5	1	1
33	716132	1489176	C32	1	2	1	-99	-99	4	3	5	1	0
34	716243	1489080	C22	2	3	3	6	1	3	2	2	3	0
41	713974	1486096	C22	1	2	6	6	2	3	1	2	3	0
42	713792	1485770	C32	2	2	4	3	3	4	3	2	2	0
51	722164	1484499	C31	1	2	2	-99	-99	3	2	4	2	0
52	722383	1484767	C32	1	1	1	-99	-99	3	2	4	2	0
61	705531	1485973	C32	1	1	1	-99	-99	5	2	4	2	0
63	705404	1486067	C3	1	1	4	-99	-99	3	2	4	3	0
64	705545	1486665	C32	1	1	1	-99	-99	3	1	3	3	0
71	710870	1484962	C3	1	1	1	6	1	2	1	4	3	0
72	711039	1486512	C3	1	1	1	-99	-99	3	1	4	3	0
81	724637	1489226	C22	1	2	1	2	2	4	2	3	2	0
82	724332	1489154	C32	1	1	1	-99	-99	3	1	4	2	0
91	702954	1486628	D1	1	1	1	2	1	4	3	5	2	1
92	703800	1486700	D1	1	4	5	2	1	4	3	5	1	1
93	702900	1485453	D1	1	1	1	-99	-99	5	3	5	2	1
102	706287	1477494	C32	1	1	4	-99	-99	3	3	3	3	0
103	706001	1478334	C32	1	1	1	-99	-99	2	2	4	4	0
112	700627	1470982	C22	1	2	1	-99	-99	3	1	2	3	0
113	701037	1471390	D3	1	2	1	6	1	3	1	3	3	0
125	716800	1482068	D3	1	2	1	-99	-99	3	2	5	2	1
126	716944	1482098	D3	1	1	1	-99	-99	4	1	4	2	1
128	713553	1482131	C22	1	1	1	3	2	4	1	4	2	0
131	697178	1516010	C32	1	2	1	3	3	3	1	4	3	0
132	697267	1515966	D1	2	2	1	2	2	1	-99	3	5	0

133	697408	1516065 C32	1	2	2	2	1	3	1	4	4	0
134	697497	1516048 C31	1	1	2	6	2	6	2	3	1	1
135	697665	1516163 C22	1	2	2	-99	1	2	2	3	3	0
137	698448	1517222 D2	1	1	1	-99	-99	3	2	4	3	1
138	697984	1516089 C32	1	1	2	-99	-99	2	1	1	0	1
139	698081	1515960 C21	1	1	3	2	1	2	1	3	3	0
161	698833	1508269 E	1	2	2	6	1	3	2	4	2	0
162	698960	1508240 D3	1	1	1	-99	-99	4	4	5	1	1
163	699295	1507570 E	1	1	1	-99	-99	2	1	3	3	0
164	699177	1507526 E	1	2	1	-99	-99	3	2	4	3	1
171	736512	1512178 C22	1	2	2	-99	1	2	1	4	3	0
172	736856	1512615 D1	1	1	2	2	3	2	1	4	2	0
176	734133	1516642 D1	1	1	1	-99	-99	2	1	4	3	1
181	735610	1509516 C32	1	1	1	6	1	2	1	4	4	0
182	732375	1509703 D2	1	1	1	-99	-99	2	1	5	2	1
184	730132	1509616 C22	2	1	5	6	1	2	1	3	4	0
185	731045	1509015 D2	1	1	1	6	1	3	3	4	2	1
193	744553	1538205 C32	1	2	3	-99	-99	2	1	3	4	0
194	744105	1538252 C1	1	2	4	1	2	2	2	4	2	0
195	744350	1535248 D1	1	1	1	-99	-99	3	3	5	3	1
196	743657	1529915 D1	1	1	1	-99	-99	2	3	4	3	1
199	747556	1530744 C22	1	2	3	6	1	2	1	4	3	0
202	738469	1512588 C22	1	2	1	2	1	3	1	3	3	0
203	738837	1513061 C32	1	1	1	-99	-99	2	2	4	2	0
206	740080	1516099 C21	1	2	2	6	1	2	2	4	2	0
207	743193	1512042 C32	1	1	1	-99	-99	2	1	4	3	0
208	743805	1522486 D2	1	3	1	-99	-99	3	1	4	2	1
221	726964	1511227 C21	1	2	2	5	1	2	2	4	2	0
222	726675	1511987 C22	1	2	2	5	2	3	2	4	2	0
223	726524	1512242 C22	1	1	1	-99	-99	2	2	4	3	0
251	692617	1487631 C32	1	1	2	-99	1	2	2	4	3	0
262	686074	1481038 AC1	2	3	2	-99	-99	2	3	4	2	0
263	684666	1480118 D1	1	2	1	-99	-99	2	3	4	2	1
264	684597	1480139 C22	2	2	2	5	2	2	3	3	2	0
271	698956	1519045 C2	1	2	1	-99	3	2	2	3	2	0
272	699185	1519133 C3	1	2	2	-99	-99	3	1	4	3	0
274	698425	1519512 D	1	1	1	-99	-99	2	1	4	2	1
275	698235	1519777 C2	1	2	2	4	1	3	2	3	3	0
281	694822	1504214 D	1	1	1	-99	-99	3	4	5	1	1
282	694605	1504260 D	1	1	1	-99	-99	2	2	4	2	1
283	687639	1510032 C2	1	2	3	6	3	3	2	3	2	0
284	687737	1509995 D1	1	1	1	-99	-99	3	1	5	2	1
291	696988	1500914 C2	1	2	2	5	2	2	1	3	4	0
292	701000	1501300 C3	1	2	1	-99	-99	2	1	4	2	0
301	720952	1479632 D	1	1	1	-99	-99	2	1	4	2	1
302	719409	1477845 D	1	1	1	-99	-99	2	1	4	2	1
303	716331	1472904 C2	1	3	3	5	3	2	1	3	2	0
304	716220	1476918 C22	2	3	1	-99	-99	1	-99	2	4	0
305	716217	1476983 C3	2	3	1	-99	-99	1	-99	2	4	0
306	716307	1477120 C3	1	2	1	-99	-99	1	-99	2	4	0
307	716323	1477274 D	1	1	1	2	1	2	1	3	4	0
311	727904	1474552 C3	1	2	2	6	2	3	2	3	2	0
312	728712	1473237 C2	1	2	1	5	1	3	2	3	3	0
313	728952	1469645 C3	2	1	1	2	3	3	1	2	4	0
314	728893	1469495 D	2	1	1	-99	-99	1	-99	4	2	1
315	730064	1469261 C2	2	3	1	3	3	2	1	2	4	0
316	730495	1468928 C32	1	2	1	-99	-99	1	-99	3	4	0
321	720946	1475532 C3	1	2	3	2	2	1	-99	3	3	0
322	720783	1475454 C3	1	2	2	-99	-99	2	1	2	4	0
323	720345	1475519 B2	1	2	6	6	3	1	-99	2	2	0
324	719280	1475610 C2	1	2	1	5	2	2	1	3	4	0
325	718895	1475894 C3	1	2	2	6	1	2	1	3	4	0
331	692410	1487377 AC1	1	2	2	-99	-99	2	1	4	2	0

332	693526	1483204	C22	1	1	1	-99	1	2	2	4	3	0
333	690581	1485762	C32	1	1	1	-99	-99	2	1	3	3	1
334	686177	1490572	D2	1	1	1	-99	-99	3	3	5	2	1
335	692344	1484518	C32	1	1	1	3	2	2	1	4	2	1
341	737552	1510850	D	1	1	1	-99	-99	2	2	5	2	1
342	737206	1510356	C32	1	2	1	-99	-99	2	1	3	4	0
343	737401	1510649	D2	1	2	1	-99	-99	2	2	4	2	1
344	736108	1508676	C32	1	2	1	-99	-99	1	-99	2	5	0
345	737746	1508724	D2	1	1	1	-99	-99	3	1	4	4	1
351	701278	1480919	D	1	1	1	-99	-99	2	3	5	2	1
352	701367	1480729	D	1	2	1	-99	-99	4	3	4	2	1
353	701510	1480953	C2	1	2	5	-99	2	2	1	4	3	0
354	701636	1485939	C3	1	2	1	-99	1	2	1	4	3	0
355	701493	1486216	C2	1	2	5	-99	2	2	1	3	3	0
356	705012	1484673	D	1	2	1	2	2	2	2	4	2	1
357	703084	1488175	D	1	1	1	-99	-99	2	2	5	2	1
361	705939	1485252	C2	1	2	3	4	2	3	1	4	3	0
362	704848	1485746	C1	2	-99	6	6	3	1	0	3	5	0
363	703148	1487373	C3	1	2	3	5	2	2	1	4	2	0
364	702609	1488558	C3	1	2	4	5	1	2	1	4	3	0
365	704083	1486626	D	1	1	5	5	2	2	2	4	2	1
366	701923	1485385	C2	1	2	3	5	2	2	1	3	3	0
367	701964	1483827	D	1	1	2	-99	-99	2	1	4	3	1
900	708700	1440097	C32	1	2	1	-99	-99	2	1	3	4	0
700	716050	1441700	B1	1	3	6	6	4	1	-99	1	1	0
701	715088	1440880	AC1	5	6	2	-99	-99	2	1	4	3	0
702	715211	1441568	C42	2	2	2	-99	-99	2	1	4	3	0
901	718269	1436969	B2	2	2	7	5	3	1	-99	1	1	0
902	715640	1437060	-99	2	3	1	6	2	2	1	3	4	0
703	709819	1430414	C52	2	2	5	1	-99	3	1	4	4	0
704	714263	1429062	AC1	2	3	6	-99	-99	-99	1	3	4	0
705	711900	1432700	AC1	1	3	7	6	4	1	-99	1	1	0
903	711460	1433720	C22	2	2	3	6	2	2	1	3	4	0
706	712920	1429300	C52	2	3	5	3	1	1	-99	3	4	0
707	702210	1454900	C51	5	6	7	5	3	1	-99	1	1	0
708	702384	1455234	B2	2	2	6	2	2	3	2	5	2	0
904	714129	1438107	C4	2	3	6	4	2	2	1	3	2	0
905	695300	1434100	C52	2	3	5	-99	-99	2	1	4	4	1
907	687539	1440547	C32	2	2	1	4	1	2	1	4	4	0
720	689280	1442710	C42	1	2	2	-99	1	3	2	3	4	0
722	707122	1440211	B1	2	3	7	6	4	3	3	1	1	0
908	662000	1433500	B2	2	1	6	5	2	2	1	4	4	0
909	707270	1440161	C22	2	3	2	5	1	2	1	3	4	0
910	706535	1440524	C	2	3	2	6	2	2	1	3	4	0
911	702406	1448867	C52	2	3	5	-99	-99	2	1	4	4	0
724	708257	1426818	C41	2	3	3	4	1	2	1	3	5	0
725	707830	1426133	AC1	3	3	5	5	1	2	1	4	3	0
726	714392	1448644	C32	1	2	2	-99	-99	2	1	4	3	0
727	703152	1448606	B1	3	4	7	6	4	1	-99	1	1	0
728	702787	1448660	C52	2	3	6	-99	-99	2	1	3	4	0
731	699768	1456352	C42	2	3	3	5	1	2	1	3	4	0
732	700518	1456717	C42	1	2	2	6	3	3	2	5	2	0
734	712499	1448350	C21	2	3	5	5	4	5	4	5	1	1
738	670855	1442366	C42	1	2	2	-99	-99	2	1	3	4	0
739	671747	1442529	C42	1	2	2	-99	-99	1	-99	3	3	0
740	672886	1442314	AC1	2	3	4	-99	-99	1	-99	4	3	0
741	673510	1442278	AC1	5	6	6	-99	-99	1	-99	3	4	0
742	674440	1441442	C42	2	3	1	-99	-99	2	1	4	4	0
743	674400	1440841	C41	2	3	1	5	2	2	1	4	3	1
746	670751	1448235	C52	2	3	3	-99	-99	1	-99	4	3	0
747	672749	1449614	B2	2	3	5	5	3	1	-99	2	2	0
748	665523	1451576	C42	1	2	2	-99	-99	2	1	4	3	0
749	666232	1451527	C42	1	1	1	-99	-99	2	1	5	3	1

753	664515	1448645	B1	3	4	7	-99	-99	1	-99	2	3	0
754	664645	1446880	C42	1	2	2	5	1	2	1	4	2	0
755	664613	1448364	C21	1	2	2	5	3	3	3	2	1	1
756	663957	1446751	C42	1	2	1	-99	-99	2	2	5	3	1
757	683138	1445226	C32	1	2	1	-99	-99	2	1	4	3	0
758	682982	1444175	C22	1	2	1	6	3	3	3	5	1	1
912	713590	1449982	C32	2	2	3	4	2	2	1	4	3	0
760	690600	1439700	B2	1	2	2	-99	-99	1	-99	5	1	0
761	691893	1437648	C42	1	2	1	-99	-99	3	2	3	3	0
768	695959	1435700	AC1	4	5	6	2	1	2	1	3	3	0
769	695740	1435815	AC1	3	4	5	-99	-99	1	-99	3	4	0
770	695568	1435465	C52	2	3	7	-99	-99	2	1	4	3	0
772	693122	1434720	C42	1	2	1	-99	-99	2	2	3	2	0
774	699250	1434520	AC1	5	7	7	5	1	1	-99	2	3	0
776	690678	1435331	C42	1	2	-99	-99	-99	-99	-99	-99	-99	0
777	699350	1434460	AC1	5	6	7	5	1	1	-99	2	3	0
778	650175	1434977	C42	1	2	2	-99	-99	2	2	4	3	0
780	689529	1434172	C32	1	1	1	-99	-99	3	2	4	3	0
784	688750	1434050	B1	2	3	1	-99	-99	1	-99	5	2	1
789	690400	1460700	B2	1	2	6	4	1	1	-99	4	4	0
790	687067	1467091	C42	1	2	1	-99	-99	1	-99	3	4	1
792	687234	1467204	C42	1	2	1	-99	-99	1	-99	3	4	0
795	693454	1455467	C42	1	2	1	-99	-99	2	1	3	4	0
799	692499	1454170	C51	1	2	4	6	3	3	2	2	2	1
801	690431	1460599	B2	2	3	5	4	1	2	1	3	4	0
803	690271	1460862	C41	1	2	3	6	2	3	2	4	3	0
805	691400	1463000	AC1	6	7	7	5	1	1	-99	4	4	0
807	689550	1462800	AC1	2	3	6	-99	-99	1	-99	3	4	0
811	724200	1431000	C52	2	3	3	-99	-99	1	-99	3	4	0
813	717800	1441300	C22	1	2	3	-99	-99	2	2	5	3	1
814	716100	1442500	C32	2	3	2	5	2	3	2	4	3	0
815	714400	1443700	D2	1	2	5	-99	-99	2	1	5	2	1
825	707442	1443537	C42	1	2	1	-99	-99	1	-99	3	4	0
828	708500	1429300	C42	1	2	4	-99	-99	2	1	4	4	0
829	707605	1433840	C31	1	1	2	-99	-99	3	1	3	4	0
830	707503	1434400	D2	1	1	2	-99	-99	3	1	5	2	1
837	659211	1434578	C21	1	1	2	6	3	3	2	5	2	1
839	668670	1435390	C42	1	1	1	-99	-99	1	-99	5	2	1
913	688750	1434110	C31	2	3	5	6	4	5	4	1	1	1
914	723500	1436700	C32	1	2	3	-99	-99	3	2	4	3	0
915	708498	1428399	C32	1	2	4	-99	-99	1	-99	3	4	0
916	668702	1435800	C21	1	1	4	6	3	3	2	5	2	0
917	689622	1442062	C41	1	2	2	5	2	3	1	4	3	0
918	694511	1443321	AC1	5	6	6	-99	-99	1	-99	3	4	0
919	695116	1443142	C52	2	3	4	5	2	3	1	4	4	0
920	697689	1444408	C42	2	2	2	4	1	2	1	4	3	0
921	697686	1444400	C31	1	2	2	6	3	3	2	5	2	0
922	698601	1444732	D2	1	1	1	-99	-99	-99	-99	4	3	1
923	697689	1444100	C32	2	2	2	4	1	2	1	4	3	0

Annex 6b. Soil horizon data

Plot nr	Horizl	Horiz up	Horiz low	Textur	Rock	Nod	Struct size	Struct form	Ang	Cons	Legend map
123	A	0	4	3	1	1	4	5	0	4	C32
123	B	4	20	4	1	1	3	2	0	4	C32
123	Bg	20	40	4	1	1	3	2	0	4	C32
123	C	40	130	10	1	3	4	2	0	5	C32
121	A	0	3	3	1	1	4	2	0	5	C21
121	B1g	3	40	3	1	1	3	2	0	4	C21
121	B2g	40	60	4	4	3	2	2	0	4	C21
121	B	60	120	4	6	6	-99	-99	-99	4	C21
122	1A	0	20	1	2	1	-99	-99	-99	2	C21
122	2A	20	35	3	2	1	-99	-99	-99	4	C21
122	2B1g	35	60	4	2	1	-99	-99	-99	4	C21
122	2B2g	60	80	10	2	1	3	2	0	5	C21
122	2B	80	120	4	6	6	-99	-99	-99	4	C21
4	A	0	20	2	5	-99	-99	-99	-99	2	C22
4	B	20	100	4	3	-99	-99	-99	-99	3	C22
6	A	0	40	3	1	1	-99	-99	-99	3	D
6	B1	40	60	3	1	1	-99	-99	-99	3	D
6	B1g	60	100	1	1	2	-99	-99	-99	2	D
6	B2g	100	115	2	2	4	-99	-99	-99	2	D
6	B2	115	120	2	3	5	-99	-99	-99	2	D
7	A	0	30	4	2	2	-99	-99	-99	5	D
7	Bg	30	45	3	1	3	-99	-99	-99	4	D
124	A	0	20	3	1	1	3	2	0	3	C32
124	B	20	40	4	1	1	3	2	0	4	C32
124	B2	40	130	10	1	7	-99	-99	-99	3	C32
12	A	0	10	4	6	-99	-99	-99	-99	1	B2
13	A	0	7	3	1	1	3	2	0	4	C32
13	B	7	25	4	1	1	3	2	0	5	C32
13	B1g	25	55	3	1	1	3	2	0	5	C32
13	B2g	55	85	3	1	1	3	2	0	5	C32
13	B3g	85	120	4	1	2	2	2	0	5	C32
14	A	0	40	4	6	-99	-99	-99	-99	1	C2
15	A	0	20	4	1	-99	-99	-99	-99	3	C3
15	B	20	50	4	-99	-99	-99	-99	-99	3	C3
16	A	0	30	3	1	-99	-99	-99	-99	-99	C3
16	B1	30	60	3	1	-99	-99	-99	-99	-99	C3
16	B2	60	100	4	6	-99	-99	-99	-99	-99	C3
17	A	0	30	2	1	-99	-99	-99	-99	-99	A
17	B	30	60	3	1	-99	-99	-99	-99	-99	A
17	C	60	90	3	1	-99	-99	-99	-99	-99	A
17	C	90	120	4	4	-99	-99	-99	-99	-99	A
21	A	0	20	3	-99	-99	-99	-99	-99	-99	C21
21	ABg	20	40	3	1	-99	-99	-99	-99	-99	C21
21	B1g	40	70	10	1	-99	-99	-99	-99	-99	C21
21	B2g	70	90	4	-99	-99	-99	-99	-99	-99	C21
21	C	90	110	4	4	-99	-99	-99	-99	-99	C21
23	C1	0	10	1	2	-99	-99	-99	-99	1	C21
23	A	10	20	3	-99	-99	-99	-99	-99	1	C21
23	AB	20	30	4	-99	-99	-99	-99	-99	1	C21
23	B1g	30	50	4	1	-99	-99	-99	-99	1	C21
23	B2g	50	120	4	1	-99	-99	-99	-99	1	C21
24	A	0	20	3	1	-99	-99	-99	-99	5	B1
24	B	20	40	3	3	-99	-99	-99	-99	3	B1
26	A	0	30	2	-99	-99	-99	-99	-99	2	C32
26	B	30	80	4	-99	-99	-99	-99	-99	1	C32
26	Bg	80	120	4	-99	-99	-99	-99	-99	1	C32
31	A	0	20	4	1	-99	-99	-99	-99	3	C32
31	ABg	20	30	4	1	-99	-99	-99	-99	-99	C32

31	B1g	30	100	4	1	-99	-99	-99	-99	-99	C32
31	B2g	100	120	4	1	-99	-99	-99	-99	-99	C32
32	A	0	5	4	1	-99	-99	-99	-99	-99	D2
32	B1g	5	80	10	1	-99	-99	-99	-99	-99	D2
32	B2g	80	120	10	1	-99	-99	-99	-99	-99	D2
33	A	0	20	4	2	-99	-99	-99	-99	-99	C32
33	B1g	20	70	10	-99	-99	-99	-99	-99	-99	C32
33	B2g	70	-99	10	1	-99	-99	-99	-99	-99	C32
34	A	0	10	2	4	-99	-99	-99	-99	2	C22
34	B	10	40	2	4	-99	-99	-99	-99	2	C22
41	A	0	10	4	7	-99	-99	-99	-99	2	C22
41	B	10	40	4	7	-99	-99	-99	-99	2	C22
42	A	0	70	4	2	-99	-99	-99	-99	2	C32
42	B	70	90	4	2	-99	-99	-99	-99	2	C32
51	AB	0	20	4	1	-99	-99	-99	-99	2	C31
51	B1g	20	70	4	1	-99	-99	-99	-99	2	C31
51	B2g	70	100	4	1	-99	-99	-99	-99	2	C31
51	B3g	100	110	4	3	-99	-99	-99	-99	2	C31
51	B4g	110	120	4	1	-99	-99	-99	-99	2	C31
52	A	0	30	4	1	-99	-99	-99	-99	2	C32
52	B	30	70	4	1	-99	-99	-99	-99	3	C32
52	Bg	70	120	4	1	-99	-99	-99	-99	3	C32
61	A	0	60	10	1	-99	-99	-99	-99	4	C32
61	Bg	60	80	10	3	-99	-99	-99	-99	1	C32
63	A	0	40	3	6	-99	-99	-99	-99	3	C3
64	A	0	30	2	1	-99	-99	-99	-99	2	C32
64	B1g	30	70	4	2	-99	-99	-99	-99	-99	C32
64	B2g	70	120	10	1	-99	-99	-99	-99	-99	C32
71	A	0	30	2	1	-99	-99	-99	-99	1	C3
71	B1g	30	50	2	5	-99	-99	-99	-99	2	C3
71	B	50	100	4	3	-99	-99	-99	-99	2	C3
71	B2g	100	120	10	4	-99	-99	-99	-99	2	C3
72	A	0	20	3	1	-99	-99	-99	-99	2	C3
72	B1	20	40	3	1	-99	-99	-99	-99	2	C3
72	Bg	40	50	4	1	2	-99	-99	-99	0	C3
72	B2g	50	-99	4	2	-99	-99	-99	-99	5	C3
81	B2g	100	120	4	4	-99	-99	-99	-99	-99	C22
81	A	0	30	2	1	-99	-99	-99	-99	3	C22
81	B	30	70	4	2	-99	-99	-99	-99	-99	C22
81	B1g	70	100	4	2	-99	-99	-99	-99	-99	C22
82	A	0	30	2	1	-99	-99	-99	-99	2	C32
82	B	30	60	3	1	-99	-99	-99	-99	2	C32
82	Bg	60	80	3	1	-99	-99	-99	-99	2	C32
91	A	0	40	10	1	-99	-99	-99	-99	4	D1
91	B1g	40	60	10	2	-99	-99	-99	-99	-99	D1
91	B2g	60	90	3	2	-99	-99	-99	-99	-99	D1
91	B3g	90	110	2	1	-99	-99	-99	-99	-99	D1
91	B4g	110	120	2	4	-99	-99	-99	-99	-99	D1
92	A	0	20	4	3	1	-99	-99	-99	-99	D1
92	B1g	20	100	11	1	3	-99	-99	-99	-99	D1
92	B2g	100	120	3	1	1	-99	-99	-99	-99	D1
93	A	0	20	11	1	-99	-99	-99	-99	4	D1
93	B1g	20	40	11	1	-99	-99	-99	-99	-99	D1
93	B2g	40	110	11	1	-99	-99	-99	-99	-99	D1
93	B3g	110	120	11	1	-99	-99	-99	-99	-99	D1
131	A	0	20	3	2	1	1	2	0	5	C32
131	B	20	120	3	2	2	2	2	0	4	C32
132	A	0	65	2	2	2	-99	-99	-99	1	D1
132	B1	65	80	3	5	1	-99	-99	-99	4	D1
132	B2	80	130	3	2	2	3	2	0	3	D1
102	A	0	20	4	1	-99	-99	-99	-99	3	C32
102	B1g	20	40	4	1	-99	-99	-99	-99	3	C32
102	B2g	40	70	4	4	-99	-99	-99	-99	3	C32

103 A	0	20	2	1	-99	-99	-99	-99	2	C32
103 B	20	70	4	2	-99	-99	-99	-99	3	C32
103 B1g	70	120	1	2	-99	-99	-99	-99	2	C32
103 B2g	120	170	1	1	-99	-99	-99	-99	2	C32
103 B2	170	-99	10	1	-99	-99	-99	-99	2	C32
112 A	0	20	2	1	1	-99	-99	-99	2	C22
112 B1g	20	40	2	1	-99	-99	-99	-99	2	C22
112 B2g	40	80	3	1	1	-99	-99	-99	-99	C22
112 B3g	80	110	4	1	1	-99	-99	-99	-99	C22
112 B4g	110	120	4	5	2	-99	-99	-99	-99	C22
113 A	0	30	2	-99	-99	-99	-99	-99	2	D3
113 B	30	50	3	1	-99	-99	-99	-99	2	D3
113 Bg	50	60	4	4	2	-99	-99	-99	2	D3
125 A	0	70	10	1	1	3	2	0	6	D3
125 B	70	100	-99	1	7	-99	-99	-99	6	D3
126 A	0	15	2	1	-99	-99	-99	-99	2	D3
126 B1	15	50	4	3	-99	2	2	0	3	D3
126 B2g	50	130	4	3	2	-99	-99	-99	5	D3
128 1A	0	5	1	1	1	-99	-99	-99	1	C22
128 2A	5	15	3	1	1	2	2	0	5	C22
128 B1	15	45	4	1	1	3	2	0	5	C22
128 Bg	45	120	4	2	3	3	2	0	4	C22
133 A	0	25	3	1	1	2	2	0	5	C32
133 B1	25	35	4	5	1	2	2	0	5	C32
133 B2	35	115	4	2	1	3	2	0	5	C32
134 A	0	25	4	1	1	3	2	0	5	C31
134 B1	25	70	4	2	1	2	2	0	5	C31
134 B2	70	130	4	3	4	3	2	0	5	C31
135 A	0	25	4	2	1	3	2	0	5	C22
135 B1	25	50	4	7	1	1	2	0	5	C22
137 A	0	40	4	1	1	3	2	0	5	D2
137 B1g	40	90	4	1	1	3	2	0	5	D2
137 B2g	90	120	3	2	-99	3	2	0	4	D2
138 A	0	20	3	2	-99	-99	-99	-99	5	C32
138 B	20	50	4	2	-99	-99	-99	-99	5	C32
139 A	0	20	3	2	-99	-99	-99	-99	4	C21
139 B1g	20	40	4	2	-99	-99	-99	-99	4	C21
139 B1	40	60	19	3	-99	-99	-99	-99	4	C21
139 B2	60	80	10	5	-99	-99	-99	-99	4	C21
161 A	0	40	2	2	-99	-99	-99	-99	3	E
161 B	40	100	4	2	-99	-99	-99	-99	-99	E
161 Bg	100	120	4	3	-99	-99	-99	-99	-99	E
162 A	0	80	11	1	1	-99	-99	-99	6	D3
162 Bg	80	120	11	1	6	-99	-99	-99	6	D3
163 A	0	30	2	1	1	-99	-99	-99	3	E
163 B	30	80	3	1	1	-99	-99	-99	3	E
163 B1g	80	140	2	1	4	-99	-99	-99	-99	E
163 B2g	140	220	10	1	3	-99	-99	-99	-99	E
164 A	0	30	3	1	1	-99	-99	-99	-99	E
164 B	30	50	4	1	1	-99	-99	-99	-99	E
164 Bg	50	80	4	1	1	-99	-99	-99	-99	E
171 A	0	20	3	1	-99	-99	-99	-99	2	C22
171 Bg	20	70	4	2	2	-99	-99	-99	5	C22
172 B	30	70	4	2	5	-99	-99	-99	4	D1
172 A	0	30	3	2	1	-99	-99	-99	5	D1
176 A	0	40	4	-99	1	-99	-99	-99	2	D1
176 B1g	40	70	4	1	2	-99	-99	-99	2	D1
176 B2g	70	120	2	2	2	-99	-99	-99	2	D1
181 A	0	20	3	1	-99	-99	-99	-99	2	C32
181 B1g	20	50	4	2	-99	-99	-99	-99	4	C32
181 B2g	50	100	10	1	-99	-99	-99	-99	4	C32
181 B3g	100	120	10	1	2	-99	-99	-99	4	C32
182 A	0	20	10	1	-99	-99	-99	-99	5	D2